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Service to the Community.

WHERE there are signs of a greater disposition on the part of members of the community to consider more closely their personal and individual relation to the community as a whole, it is obvious that influences are at work which may enure to the maintenance of a higher standard of life, and simultaneously operate to the common good.

This inference follows the assumption, of course, that such examination of relationship does not pay too much regard to claims and "rights" and too little to duty, obligation, and responsibility.

It may be thought idealistic to advocate the following out in the practical affairs of every day of the high conception that it is better to give than to receive, yet it is unquestionably sound in regard to character development that a constant attitude of receiving, whether from the State or from individuals, is detrimental, and that moral stamina and other sterling qualities become established in oneself as the direct consequence of the process of making unselfish effort on behalf of others.

It is, however, inevitable that nine hundred and ninety-nine men and women out of a thousand are following a profession, trade or avocation because they require salaries, wages, or profits. Few can consider before they enter upon a career where they can do their best for the community; a variety of causes—social, economic, temperamental, and so on—operate together to decide that for them. But when they are established in the compass of a calling, other thoughts accompany those regarding the making of a competency, though for most men it is difficult to rise to superior heights of service to the community if one is constantly harassed by the problem of finding food and clothing and, nowadays, sleeping room, for one's dependents.

It has long been a favourite pastime at conferences, for presidents and other speakers to expatiate upon the importance of their own particular class as a section of the community. Commercial and industrial men, engineers, the teaching profession, electrical wiremen, transport workers, and so forth and so on, all have a very keen idea of the value of their own essential service. The other man's work is not actually depreciated in words, but it is in effect, by the glorification of one's

own lot as a basis for better economic recognition and appreciation. A high opinion of one's calling is not to be condemned provided that because we all serve one another in some form or other we do not all together arrive at an impractical view of our importance. We fear that that has been one of the evils that we have suffered from in recent years. This, that, and the other occupation was badly paid in years gone by and it became the fashion to say that such a state of things must not continue; the result is that very few are really any better off and many are far poorer than they ever were. If we are going to continue drawing out more than we put in, somebody must be the worse off. On the other hand, if we put in greater effort and produce more as the result of that effort, we can draw more and the standard of living can rise.

We watched a bricklayer building a wall last week. Well-dressed, prosperous, with cigarette between his fingers as he spread his cement and laid his bricks—he was having the time of his life, it seemed. Years ago we saw things done differently; we are not anxious for the old conditions to return, but what is the community paying to-day for the "improved conditions" secured by this sheltered bricklaying trade? Is it not the fact that hundreds of thousands of men, women and children are being compelled to live in conditions which are a disgrace from the standpoint of health and morality, and hundreds of thousands of young married couples are being compelled to pay a large proportion of their wages or salaries for rent because the prosperous condition of the bricklayer and those for whom he stands keeps the cost of housebuilding at extortionate figures? If bricks were more rapidly laid, that would be increased production, but the cigarette between the fingers struck us as being a type of the selfish tendency that is so widely prevalent in this third decade of the twentieth century. This is what we mean by receiving without giving; taking out more than we put in; imposing a burden on other sections of the community by the pursuance of the "every man for himself and the devil take the hindermost" attitude. But it is not only the bricklayer who is open to criticism; we merely cite him as an example. The same disposition is to be found in retail shopkeepers who have sprouted out into marked prosperity during the last few years, the while the community complains of the high cost of living. It is found in some electrical artisans who are obsessed with the idea that their service is of exceptional value to the State, because if they withhold it other sections of the community will be plunged into darkness and the wheels of industry will cease to revolve. If we could but regard ourselves as interdependent, as serving each other, instead of exaggerating our individual importance by divorcing that value of service consideration from our dependence upon other sections of the community, we might be nearer to that state of harmony of which we have been talking so long.

We observe that some of the matters that we have just referred to receive prominent attention in a quarterly report just issued by Mr. W. A. Appleton, the secretary of the General Federation of Trade Unions. He shows that wages and food prices are related subjects, and remarks upon the uselessness of expecting "industrial peace while the disparities between pre-war and post-war earnings and prices continue."

Most people have felt for a long time past that there must be a thorough investigation of the reasons for the high cost of food, and the Government has set up a Royal Commission. It is profoundly to be hoped that the mere fact that an official inquiry is being made will have a salutary effect upon those who have been gaining unfair advantage from the community, but there are many factors at work which are responsible for price maintenance in this connection, and high wages earned in some trades may be causing higher food prices for everybody with the need for better wages all round to meet the cost. However, whatever the Commission discovers or achieves, everybody will agree with Mr. Appleton that "this question of food prices concerns the employers as much as the workmen," for "upward rigging of the food market, and high prices, must react and find expression in demand for wages." He adds that "men work to live," not having "generally reached that ethical perfection which leads them to continue in uncongenial, as well as congenial, effort just for the love of the thing," in which he is quite in agreement with what we have said about the "service to the community" consideration being unable to have free play while it is impossible to "make the ends meet." It is, however, an indisputable fact, that some classes of workers could do something tangible to ease both their own and other peoples' burdens by giving a greater output or longer working service without receiving a less wage than at present.

The attention of engineers has been called to matters of this kind in a suggestive way in several recent presidential addresses. Dr. Haldane in his inaugural address to the Institution of Mining Engineers (Elec. Rev., October 10th, p. 536), referred to the need for human comradeship in the coal-mining industry and its spiritual value capable of inspiring the highest and most unselfish form of service. He defined comradeship as "just action based on the placing of value upon the interests of neighbours."

The president of the Institution of Civil Engineers has dwelt recently upon the importance of the work of the engineer in connection with the life of a city, a consideration which may well evoke feelings of pride, and this is over and above any question of pecuniary reward, commission, salary, or profit that his engineering service may yield.

The electrical engineer has been asked to view his favoured position in the community from another and even more interesting standpoint. We refer to the closing remarks in the address of Mr. T. B. Johnson to the North-Midland Centre of the I.E.E. (Elec. Rev., November 21st, p. 797). The speaker in this case held that the electrical engineer is qualified by his avocation to be the "go-between" between employer and employed, between capital and labour—to do a great deal towards "filling the gap" and exercise a valuable influence in minimising trouble. To this we may add that many electrical engineers in the public service are in a privileged position which permits them to help the community by refraining from exercising predilection for foreign manufactures while their own kith and kin are waiting for employment. Mr. W. Lawson, in his address to the South-Midland Centre, which is abstracted in this issue, touched thoughtfully upon cognate matters.

The mining engineer, the civil engineer, and the electrical engineer follow their callings primarily because they have to do so in order to gain a livelihood, but they have the satisfaction of knowing that while serving themselves they can in a peculiar way be serving the State and their fellows through the very nature of the work that they have to perform. To be a harmoniser, a peace-maker, a man to bring about an understanding in place of friction, goodwill in place of suspicion and distrust—this is a very admirable *rôle* to fill, especially in times like this, but taking the long view, it is but a temporary and incomplete *rôle*. If everybody in the two classes—employer and employed—were filled with the service to the community idea, there would be no need for any "go-between," for there would be no extremes to join, as they would have disappeared in the fusion of the whole, each being imbued with the idea of giving reasonable service and taking a reasonable return which would not penalise others.

Rural Electrification.

The subject of supplying electricity to farmers and other residents in rural areas has been very seriously studied in the United States of late; "the first experimental rural electric line in the world" has been erected in Minnesota, under the guidance of a representative State Committee, and similar lines are being installed in other States. In October a conference was

held at Red Wing, Minn., near this line, at which delegates attended from various parts of the Republic, representing the farmers, the State agricultural colleges, manufacturers of electrical and farming equipment, and electricity supply companies. The members visited the farms fed by the experimental line and studied the problems that were met with, after which they sat in conference and resolved on active co-operation between the interests that they represented, to deal with the vast potentialities of rural electrification.

The questions discussed related to the best mode of gearing the motors to the machines, the desirability of standardisation, the most suitable voltage for rural lines, the choice between single- and three-phase currents, the feasibility of electric ploughing on large farms, &c. The complete electrical equipment found in the houses on the Red Wing Farm Line, including washing machines, cookers, mangles, pumps, &c., excited much interest, being fully up to city standards, and the immense scope for the improvement and development of electrical farming machinery was generally recognised.

These particulars are gathered from an article by Mr. C. F. Stuart, general manager of the Northern States Power Company, which erected the experimental line, in the *Bulletin* of the National Electric Light Association, and they contain a lesson for us, to be added to the teachings of the Continental nations which have already made so much progress in this direction. We would add to what we have said on previous occasions that the question is not one which concerns only one section of the industry—it affects manufacturers of electrical apparatus of every description very directly, as well as the suppliers of electricity; and, of course, it is of great importance to farmers and manufacturers of agricultural machinery. But these several classes *do not know it*. We need a conference such as that described above, to bring home to all parties the magnitude of the problem and its vital importance to the community. Even a minor industry such as poultry farming, as Mr. R. Borlase Matthews shows elsewhere in this issue, represents a vast amount of plant, and a possible consumption of no less than 25,000,000 kWh per annum in this country. There are over 400,000 farms in England and Wales, of which about 40,000 are over 150 acres in extent and would profit materially by the aid of electricity; a large proportion of the smaller farms are also potential consumers, and to these must be added the inhabitants of villages and isolated houses in rural areas, to whom the electric light would be a godsend.

A German State Metal Trust?

ACCORDING to the Berlin correspondent of a London morning newspaper, "a sensation has been caused in German industrial circles by the ever-increasing indications that a Reich metal trust is in process of formation," based upon the Government monopoly of the production of crude aluminium. While this statement would seem to represent an exaggeration of the actual state of affairs, there is no doubt that great dissatisfaction has existed for some time past in aluminium consuming circles in consequence of the limited native production of crude aluminium, combined with the Government veto upon imports of this metal.

During the course of the war it was claimed that the developments in the production of aluminium in Germany would render that country independent of any foreign supplies in the future, works having been established at Bitterfeld and Grevenbroich, together with the Lauta works, all three being combined in the State company known as the Vereinigte Aluminium Werke, A.G. Besides these three State works there exists a private concern at Rheinfelden, which is in Swiss ownership, namely, the Schweizerische Rohaluminiumwerk, having an annual output of about 1,000 tons, whereas the productive capacity of the three State works is claimed by the managers to be about 27,000 tons per annum. On the other hand, consumers of aluminium declare that the production of the three State works does not exceed 10,000 tons, and that it was only 9,900 tons last year. The requirements of the country, however, are considerably in excess of the latter tonnage, but it is practically impossible to obtain import permits. In fact, permits are only granted when the managers of the three State works admit that they are either unwilling or unable to deliver the tonnage represented by any application for an import licence. The calculations which have to be made to determine whether an import licence shall or shall not be issued, hamper the acquisition of the metal by consumers, while the producing works offer strong opposition to any idea of the abolition of the import veto, as has been asked for on many occasions by the consuming interests. At the same time the works have energetically demanded the imposition of high protective duties on imports of aluminium. Consumers complain not only of the scarcity of the metal, but also of the high price charged by the State works, which act in price agreement with the Swiss-owned works. Under the circumstances it will be understood that the State works have a monopoly of the home market, while they are also said to work in price harmony with producers in other countries in the form of the International Aluminium Syndicate.

It is now alleged that the State works are making large profits, and that these are being invested in the acquisition of a controlling interest in private companies which produce copper, brass and other metals, so that in the course of time the Reich Metal Trust, as it is termed, will be in a position to dominate the electrical manufacturing industry. Having regard, however, to the very strong position of the metal controlling interests in Germany, particularly those concentrated at Frankfort-on-Maine, it would appear that the reported scheme for the constitution of a general Reich metal trust is a gross exaggeration of the actual situation of affairs, or at all events is very premature. Moreover, it is doubtful whether the Reich aluminium works are earning such large profits as are represented by the consuming interests; certainly they are far from sufficient to secure a dominating interest in the base metal works which do not produce iron and steel.

Imperial Communications.

AT the annual meeting of the Empire Press Union, the Chairman, Sir Robert Donald, advocated the appointment of an Imperial Communications Board to advise on the development of wireless telegraphy in the Empire. He pointed out that the Committee set up by the late Government to consider the proposal to improve the business organisation of the Post Office ceased to exist when the Government went out of office, though its report was nearly ready—and the new Postmaster-General did not favour its reappointment. Nevertheless, Sir Robert held that better organisation was essential, if the Post Office was to handle wireless communication with the Dominions, and everyone who has regard to the history of the Post Office and its relations with telegraphy will cordially agree with him.

Whilst we have wasted time on interminable negotiations, other countries have gone ahead; the United States and France can communicate with their ships in any part of the world, whilst the British Admiralty's wireless range is limited to 3,000 miles, and the first British station capable of communicating with the Antipodes is still in course of construction. Yet this country once led the world in the development of wireless telegraphy, and would do so now if politicians were not permitted to hamper its progress. The strong hand is needed, to put an end to the obstruction and to curb the ambition of the Post Office—to liberate wireless communication from the bondage in which it has been chained ever since the Post Office policy of absorption was framed. We hope that the new Postmaster-General, Sir William Mitchell-Thomson, will speedily inquire into the whole subject, and will not rest until he has established it on a sound basis; for the position in which this country finds itself at present is not merely humiliating—it is a public scandal and disgrace.

Electro-Farming.

Some Radical Developments in Incubation.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

IT has been left to an electrical engineer—to wit, Mr. Ll. B. Atkinson, past president of the Institution of Electrical Engineers—to write the most authoritative paper on the science of the artificial incubation of the eggs of poultry.

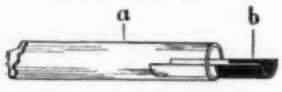
This paper was presented on November 19th before the Royal Society of Arts, and was entitled "The Scientific Principles of Artificial Incubation." The chair was taken by England's senior authority on poultry matters—Mr. Edward Brown—and many leaders of the poultry industry were present. Mr. Atkinson's paper

PHIPPS—ATKINSON INCUBATOR
HYGROSCOPE OR
MOISTURE GAUGE
103° F. LEVEL OF
THERMOMETER BULB
Centre disc should match surround.
If pink, too moist; if blue, too dry.
(Patent Applied for)
A. E. W. PHIPPS, Midland Works, Harborne, Birmingham

Fig. 1.—Atkinson Humidity Indicator.

was not a mere summary of known scientific principles, for it dealt with three most important inventions of his own development, which bid fair to revolutionise practical incubation. Further, Mr. Atkinson has reduced the principles, at which he arrived after much painstaking study and experiment, to an extremely practical form.

Hitherto, extreme care has been taken to keep the temperature within the incubator constant, and the thermometer is most carefully watched to this end, to see that the automatic temperature control devices are operating properly. So far, this has been all the scientific control. Certainly the eggs were often sprinkled haphazard with water towards the end of a hatch, and the floor of the incubator room was also often moistened. But there was no method available for checking the humidity in any way. Again, a number of scientific experiments had been



a=holder; *b*=treated paper.
Fig. 2.—Atkinson CO_2 Indicator.

made to test the amount of carbon dioxide present in natural incubation under hens. Here again there was no practical method for the poultryman to test the quantity of carbon dioxide present in his incubator, neither was there any information available to show how much was advisable, or even that it had any effect upon hatching results. The third matter, which has hitherto been entirely overlooked, is the question of difference of temperature between the top and lower surfaces of an egg. Mr. Atkinson's experiments demonstrate that a good difference of temperature is of the first importance, and is, in fact, the natural condition of the egg resting on the cold ground with its upper side against the warm body of the hen.

In the view of the writer, though Mr. Atkinson has developed these ideas as general principles of incubation, they will do a great deal to foster the application of electricity to that art. In itself it will be no mean addition to the amount of electricity consumed in this country, if a considerable number of the incubators are

Fig. 3.—Three Electric-fan Incubators, each of 10,368-egg capacity, and some of the Hatch. Dimensions, 8½ × 8½ × 7¼ ft. only.

run electrically. It would be of the order of 25,000,000 kWh per annum. As Mr. Atkinson's developments have converted incubation to a more exact and efficient science, naturally electrical operation will score over

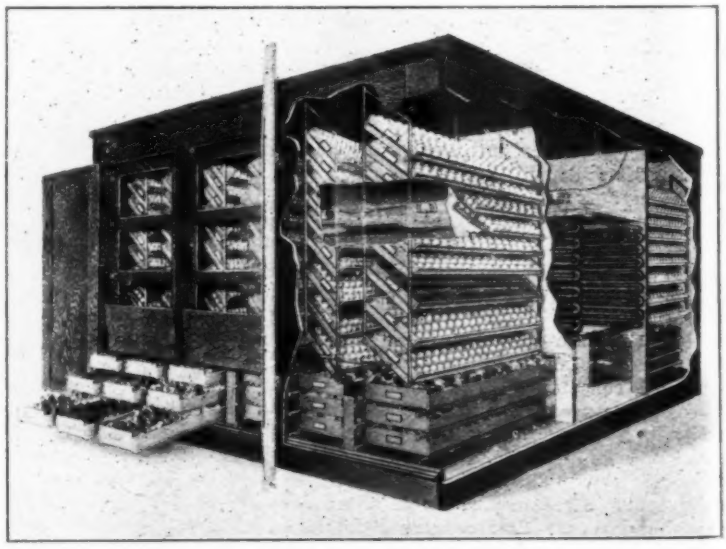


Fig. 4.—"Ghost" view of 10,368-egg Machine.

other methods, as it can be applied exactly where required. Further, all the labour of lamp trimming will be eliminated. In the paper a table is given showing that only 100 B.th.u. per hour is required, whereas 1,200 B.th.u. is necessarily produced by the ordinary incubator to provide for the 1,100 expended in needless losses.

Mr. Atkinson's simple device for indicating the

correct humidity (fig. 1) consists of a chemically treated piece of paper surrounded by a mask of the colour which the paper should assume at the correct humidity. The paper is treated with a cobalt salt, the underlying principle being the well-known one of colour change of the hydrates under different vapour-pressures. Hence all the poultryman has to do, is to place this indicator among his eggs and add a little moisture if the indicator is too blue; or try to dry out the incubator, if the indicator is too red.

For the measurement of carbon dioxide, the method consists of applying to a small piece of blotting paper,

Fig. 5.—Electric-fan Incubator in use at Greater Felcourt, capacity 2,772 eggs, showing comparatively small size of machine.

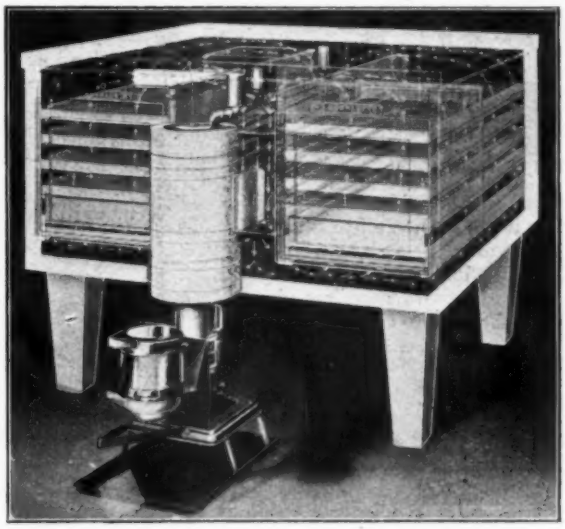


Fig. 6.—"Ghost" view of Incubator (Fig. 5), showing position of Fans and circulation of Air. Dimensions, 5 × 5 × 2¼ ft. only.

treated with a colour indicator (phenolphthalein) a definite quantity of a standard alkaline solution, which turns it a bright red (fig. 2). This strip is then introduced into the incubator and the time is noted in which the paper undergoes the colour change due to the neutralisation of the alkali by the carbonic acid. This bleaching should take place in eight minutes, when the correct concentration of carbon dioxide occurs in the incubator.

Mr. Atkinson's third invention, designed to maintain a considerable difference of temperature between the top and the bottom of the eggs, was the ingenious one of enclosing the upper or heating chamber of the incubator, by covering the eggs with a thin sheet of india-rubber, which actually rests upon the eggs. This stops too rapid evaporation, while the moisture and carbon dioxide conditions closely follow those of the hen's nest. In the autumn of this year (very late it will be observed) a bad type of incubator, which had only previously hatched 55 per cent. of the eggs placed in it, modified as indicated above, had its percentage raised to over 95 per cent.

The writer has been operating an electric-fan type incubator, with a capacity of 2,400 eggs at a time (fig. 5). He has been privileged to discuss Mr. Atkinson's work with him from time to time, and also to observe the progress of his experiments. Also the writer has made some of these new tests at Mr. Atkinson's request on his electric-fan type incubator. Over two years this incubator gave hatching results of 83½ per cent. of the fertile eggs. Then in a following season, outside eggs were purchased in considerable numbers.

Unfortunately, owing to winter, exposure in travelling and the fact (only discovered later) that immature cockerels had been mated with the hens, most of the eggs, though fertile, did not hatch out, the trouble being dead-in-shell. This led to unauthorised adjustments to the incubator which only resulted in trouble. Eventually, by the aid of Mr. Atkinson's devices, the machine was restored to proper working order. Though the principle of the electric-fan operated incubator contravenes the principle of Mr. Atkinson's third invention, it complies closely with the requirements of the first two. In this probably lies the success of this type of appliance—though not realised by either the makers or the users.

In one of the tables in the paper, the difference between the temperatures at the top and bottom of the egg in the electric fan type incubator is given as "nil." This is, however, not quite the case, as there is a slight temperature gradient for the individual egg, though nothing like that which is evidently desirable. The electric fan permits tiers of egg trays to be used. In practice the eggs are moved downwards in the chamber, being put in fresh at the top and hatching out at the bottom. While evidently the design of mammoth incubators may have to be modified, it is interesting to note that the electric-fan type is already nearer the ideal than the ordinary sized incubator.

An electrically-heated incubator of the ordinary type takes 11 kWh to hatch out 60 eggs. A 250-egg capacity machine consumes 16 kWh, *i.e.*, the larger the machine, the lower the consumption per egg. With an electric

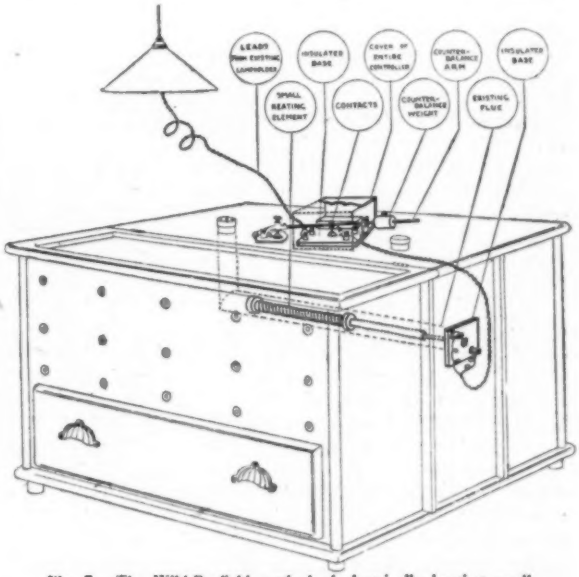


Fig. 7.—The Wild-Barfield method of electrically heating small existing Incubators.

incubator provided with an electrically-heated closed chamber on Mr. Atkinson's system, the energy consumption could probably be cut down by one-third. He has not yet, however, actually made such an experiment.

At the recent British Empire Exhibition, a model mammoth electrically-heated electric-fan type incubator

was shown in the British Electrical Development Association's electro-farming exhibit. This incubator was fitted with one of Mr. Atkinson's humidity indicators. Messrs. Spratt's showed a number of electrically-operated incubators at the same exhibition. Most incubator manufacturers to-day offer to supply electrically-heated incubators, but they do not push them. With many of them there is trouble with sparking at the make-and-break contacts, due to lack of electrical knowledge on the part of the designers. One mercury contact device actually caused trouble by poisoning newly hatched chicks—hardly an advertisement for electricity. There is a complete electric heating and regulating unit on the market (the Wild-Barfield) ready for fitting to any standard oil-burning incubator (fig. 7). This is equipped with a standard Post Office telephone condenser across the contacts; the price, however, seems to be on the high side, being about £3. In another system, devised by the author, an auxiliary resistance is thrown into, or cut out of, series with the heating coils. This avoids the sparking trouble with the small current employed. The electric-fan type incubator obviates the daily cooling of the eggs, which is required in other machines. Altogether the use of electricity in incubation is a great labour-saver.

By the way, the writer does not agree with the Editorial comments in a recent issue as to the greater efficiency of the hen as a hatching agent, compared with the artificial incubator. The remarks certainly contained an element of truth as regards a few birds kept as a hobby, but on a commercial poultry farm, far better results can be obtained by artificial incubators, especially electric-fan operated incubators (not to mention the future possibilities due to Mr. Atkinson's improvements). Further, labour is enormously reduced and more eggs can be produced on the farm, as the hens will be laying instead of setting.

Another use of an electric incubator is for testing milk. The customary bacteriological test usually takes nearly three weeks. By that time the cowmen and the bailiff have entirely forgotten the conditions which may have given rise to a bad result. A substitute for the bacteriological test is to employ an incubator which can be maintained at 60 deg. Fahr. (15 deg. Cent.) by means of a water jacket for the main cooling and an electric heater for the final control. A sample of milk which remains fresh for 24 hours at this temperature will be well within the limits of the permissible bacterial content (*i.e.*, under 30,000 per cubic centimetre—ordinary commercial milk often has as many as 2,000,000 bacteria per cubic centimetre).

From the foregoing notes it will be gathered that even what may seem to be a trivial subject has after all an important bearing on the well-being of this country, directly as well as indirectly, in the demand for electrical apparatus and electric current.

The City and South London Railway.

Completion of Work of Reconstruction.

THE City & South London Railway was not only the first tube railway ever constructed, but it was also the first electric railway in England. It became amalgamated with the London "Underground" group of electric railway companies in January, 1913, in which year powers were obtained for the entire reconstruction of the City line and for effecting certain other supplementary works. Reconstruction began in August, 1922, and the northern section of the line—between Moorgate and Euston—was closed entirely in order that by working day and night its completion might coincide with the inauguration of the Camden Town junction and the Edgware extension. This was duly achieved, and the northern section was restored to operation in April, 1924.* Work on the southern section, fig. 1—between Moorgate and Clapham Common—was likewise begun in August, 1922, but proceeded at night only, the train services being maintained till 8 p.m. until November, 1923, when they were withdrawn, and the resultant speeding up of the task in hand enabled the City and South London Railway as a whole to be reopened for traffic—virtually a new line—on December 1st, 1924.

The enlargement of the 11 ft. 6 in. tunnels, which were only $2\frac{1}{4}$ in. smaller than the standard to which the running tunnels as a whole were to be reconstructed, was effected by removing the cast-iron segments from the upper part of the tunnels in progressive stages, increasing the size of this section by hand (the clay face of the tunnel being meanwhile supported by timber) and replacing the segments, with the addition of extra large key-pieces devised especially to make the old lining fit the distended tunnel. The tunnels between The Borough and Moorgate are thus no longer exact circles, the upper half being slightly larger than the lower. In the 10 ft. 2 in. and 10 ft. 6 in. tunnels the whole of the segments were gradually removed, ring by ring, and as the tunnels were reamered out by the "Greathead" shield to the requisite diameter the lining was built up again, partly with new segments. These tunnels are now uniform with the standard 11 ft. $8\frac{1}{4}$ in. running tunnels of the other tubes. On the curves throughout the line the tunnels were enlarged to diameters varying from 12 ft. to 15 ft., according to the radius of curvature. So far as diameter was concerned, the station tunnels did not, of course, require to be enlarged; but in all cases they were lengthened to 350 ft. by enlarging to the requisite degree the adjoining running tunnels and merging these sections into the station tunnels. Between Clapham and Moorgate 39,000 tons of the iron segments that were removed from the old tunnels were cleaned and refixed in position in the enlarged tunnels.

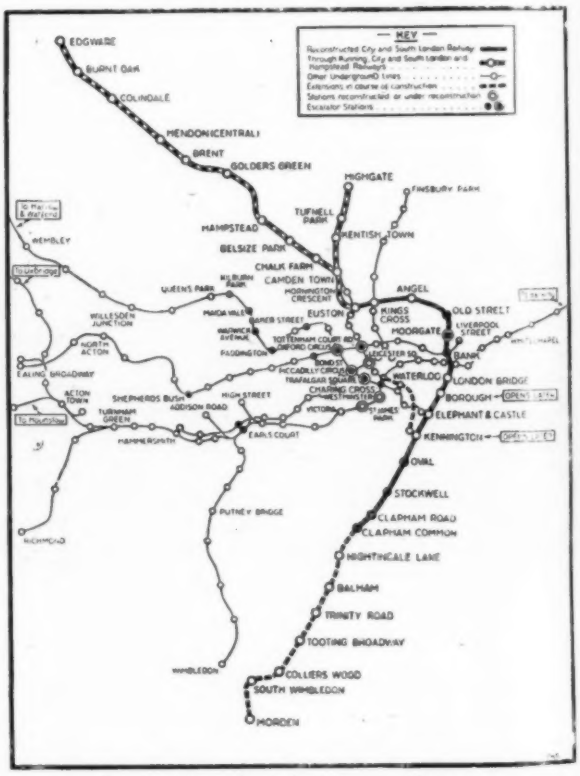


Fig. 1.—Map of London's Underground Railways.

*ELEC. REV., May 16th and August 22nd, 1924.

On the southern section, work was carried on under great difficulties imposed by the maintenance of the train services; thus, the permanent way, signalling gear, and other equipment had to be removed before the night's task could be commenced, and put back again when it ceased in readiness for the next day's traffic. When it is mentioned that during the full activity of reconstruction this sort of thing was taking place at one time at upwards of sixty points between Clapham and Moorgate, some idea will be given of the difficulties with which the engineers were confronted. In many

Fig. 2. New Clapham Common Station.

cases the merging of sections of the running into the station tunnels entailed the lowering of the base of the former, which involved the permanent way being carried temporarily on timber supports. Shields of special annular design were used for reamering, so that they could be left *in situ* during the day and the trains could pass through them; during one period of the work as many as 18 shields were simultaneously in operation. At Stockwell, where the line crosses the now underground course of the Effra brook, compressed air had to be used to keep back the water. This entailed the construction of crossovers to enable both "up" and "down" traffic to be worked in one tunnel whilst the other was shut off by the air lock. Operations under compressed air were of frequent occurrence, for water-bearing strata were encountered for considerable distances elsewhere, and pumps had to be in continual service at various places; in addition, three specially-constructed tank wagons fitted with pumps were utilised. Between The Borough and Stockwell the alignment, level, and general lay-out of the line have been vastly improved in places, particularly at Newington, where many awkward twists and turns and bad gradients have been rectified. Indeed, the tunnels in the vicinity of the Elephant and Castle are virtually new ones.

The work proceeded from shafts sunk on the route and lined with segments from the old tunnels. The lift and staircase shafts at certain stations were also brought into service by the engineers. Below ground a transport service on a grand scale was organised; it was composed of trains of wagons hauled by the electric locomotives of the old line, each train working to a pre-arranged schedule and having an allotted function in the co-ordinated scheme of operations. The 20-ton hydraulic lift at the Stockwell depôt also proved of inestimable service. The employment provided by the reconstruction and re-equipment of the line has been very considerable, and in their desire to use only British products, the "Underground" engineers have been instrumental in developing the manufacture of certain special tools, &c., that were previously obtainable only from abroad.

Fig. 3.—First Cleat-Comb Escalator.

As the first underground railway of any sort in South London, it will afford a greatly improved service, and a year or so hence the extension through Balham and Tooting to Merton and Morden will be opened; about the same time the Charing Cross-Kennington connection with the Hampstead tube will be inaugurated.

Some time has yet to elapse before all the stations will be finished: stations have been considerably improved and throughout the line the station tunnels have been retiled. Entirely new stations have been constructed at Clapham Common and Stockwell; others are being rebuilt or remodelled, and the installation of escalators is a feature. The new Clapham Common station, fig. 2, has been formed beneath the main highway, an arrangement that will be adopted for several of the stations on the Morden extension. Two escalators, working on each side of a fixed staircase, connect the booking hall with the island platform, the ascending escalator being of the new cleat-comb type, fig. 3, the first in England. The chief feature of improvement is the elimination of the shunt, or flat-moving, sections at the head and foot, which enables the passenger to step off with a forward movement and (although this does not apply at Clapham) makes for economy of space.

The old City and South London Railway had a bad reputation for "stuffiness." This defect has been remedied to a large extent by the mere process of reconstructing the line; nevertheless, special pressure

Fig. 4.—Latest Type of Rolling Stock.

plant has been installed at most stations. Each has a capacity for pumping into the tunnels up to 20,000 cu. ft. per minute of ordinary atmospheric air obtained from about 40 ft. above ground level. This is taken in through a series of ducts in the ventilating plant and circulated in the lower levels of the stations. The entirely new track equipment comprises 85-lb. bull-headed running rails on chairs bolted to jarrah sleepers, with steel positive and negative conductor rails carried on Siluminite insulators; additional crossovers have been installed at various places. Automatic signals, operated by the passage of trains, have been installed on all parts of the line where there are no points or crossovers; elsewhere the signals are controlled from cabins. All signals are electrically controlled and are fitted with train stops; the latter, like the points, are operated by compressed air controlled by electrically-operated valves. An emergency telephone system is installed throughout the running tunnels for the use of motormen.

The new all-steel cars, fig. 4, have pneumatically-operated doors, and seating accommodation is provided for 48 passengers. The air-braking equipment permits of a seven-car train, travelling at 40 miles per hour, being pulled up in 140 yards. The stock has been in operation on the northern section of the line since the latter was re-opened. Between Clapham Common and Camden Town there will be 26 trains per hour in each direction.

The World's Largest Engineering Project.—I.

The Undertaking of the Southern California Edison Co.

By T. B. ROSS.

(*Concluded from page 863.*)

Of the eight or more tunnels forming part of the B. C. project, the one joining B. C. Power House No. 8 to B. C. Power House No. 3 will have a cross section of 21 ft. by 21ft., and measure 5½ miles long, with a capacity of 3,000 cu. ft. per sec., supplying sufficient water to produce the 200,000-h.p. output planned for Power House No. 3. This is the power house below Hairpin, referred to earlier in this article, and can be seen as marked on the topographical map accompanying this article (fig. 9).

From the south portal (fig. 5) the auto road disappears into the heart of the highest mountain range, passing through the Kaiser Pass at an altitude of 9,300 ft.; still pursuing a winding course, it drops down to Florence Lake, at an altitude of 7,300 ft. The total distance by road between the two lakes is about 21 miles, and it is over this section and the adjacent mountains that most of the heavy constructional work of the project has still to be carried out. Over this territory the company has its various outlying camps, where for six months of the year the officials and workmen are entirely cut off by the snow from the rest of the world. Work is carried on the full seven days of the week, so that the men get little time to themselves for recreation.

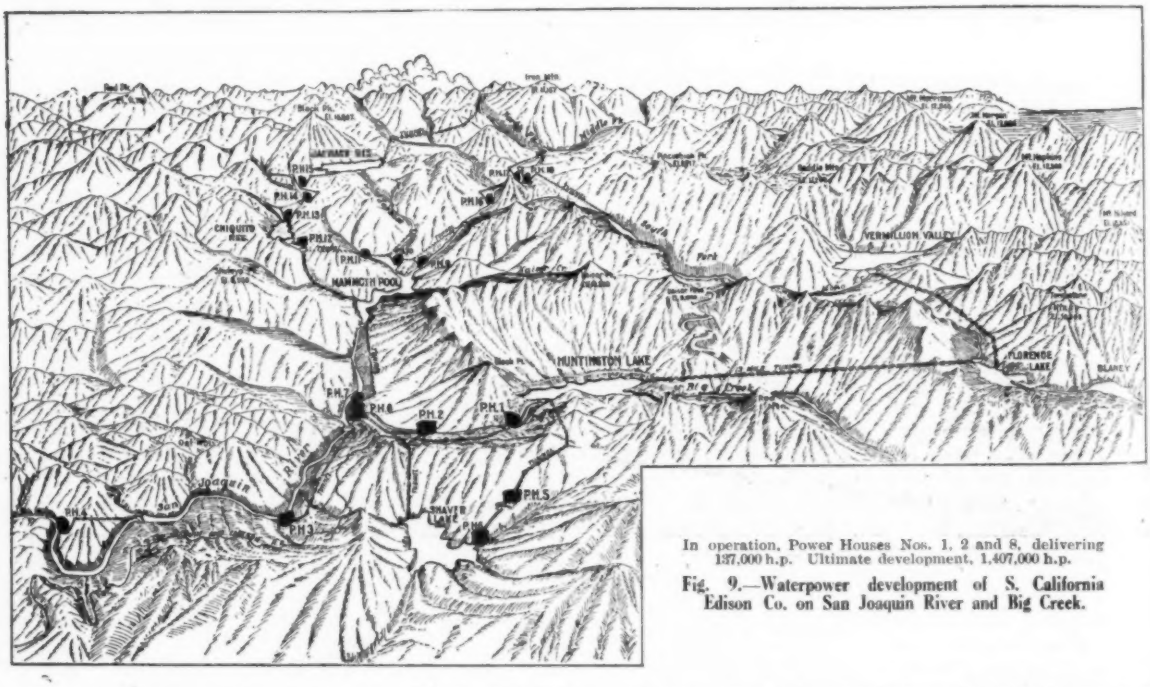
As in most American undertakings of such magnitude, there are dozens of accomplishments in connection with the work for which the great American claim of "the greatest ever" is made, and the following will serve to indicate a few of such records:—

The total cost of the project is estimated to be $375,000,000, roughly $25,000,000 more than the cost of the Panama Canal.

By 1935 the company will be able to meet the light and power needs of a population of 6,000,000 people by means of its many power houses, giving a total production of 1,500,000 h.p.

The company has at present in operation an overhead transmission line between Big Creek and a suburb of Los Angeles carrying current at 220,000 volts, over a distance of 270 miles.

When one considers that the company built its first pioneer plant 'way back in the '90's with a record transmission line (at that time) at 2,400 volts, the big



In operation, Power Houses Nos. 1, 2 and 8, delivering 137,000 h.p. Ultimate development, 1,407,000 h.p.

Fig. 9.—Waterpower development of S. California Edison Co. on San Joaquin River and Big Creek.

strides that have been made by the company's engineers and the Research Department in the development of high-voltage transmission can be appreciated. Only last autumn the company announced that its Research Department had lately carried out successful laboratory tests for a 1,000,000-volt transmission line, and it is fully anticipated by those qualified to judge such matters that current will in the near future be carried over the company's lines at this terrific pressure.

To-day, the company is developing from its various plants in operation, about 500,000 h.p. It has an operating and permanent staff of 5,000 people, in addition to which have to be reckoned the construction forces spread out in the mountains and elsewhere, whose number varies from perhaps 2,000 to as many as 5,000, according to the work in hand at the time.

The average annual expenditure of the company to-day ranges between $20,000,000 and $30,000,000, and the value of the stores and equipment shipped annually to Big Creek has for some years past been in the vicinity of $10,000,000. The company is said to be the largest consumer of high explosives of any organisation in the world engaged on construction work. In 1923 over 5,000,000 lb. of powder was used on the Big Creek project. One can picture the enormous amount of drilling, blasting, and clearing required to be done in the building of the 86 miles of tunnels, which in many instances have to be driven through mountains of solid granite ranging in height from one mile to one and three-quarter miles above sea level. Up to date about 20 miles of tunnelling has been completed.

From the above-mentioned examples it will be seen how enormous the Edison project must be, and there appears to be fair ground for the company's claim that its undertaking is to-day's largest engineering project.

The writer will give, in his next article, as far as space will permit, a detailed description of the electrical side of the project, and in the third and concluding article will deal briefly with the financing of the work, power rates to consumers, employment and other labour matters, camp life, a few of his own experiences in camp, and any other news items of the company likely to prove of interest to readers of the ELECTRICAL REVIEW and to the industry generally.

The Electrical Retailer's Catalogue.

By ERIC N. SIMONS.

THE retailer of electrical goods will often find the publication and circularisation of an efficient catalogue or price-list an invaluable means of securing more business. Electrical goods can be numbered among those commodities that practically insist upon being catalogued or listed. The ordinary domestic household has an almost constant need of electrical fittings, appliances, and so forth, especially since the wireless industry established itself as a source of home amusement; for this reason a thorough and comprehensive catalogue that could be retained in a desk or drawer for perpetual consultation would be looked upon as a most useful thing by many householders. Those sumptuous catalogues that describe articles of fashion or furniture seldom last longer than the time taken to read them, because fashions change and soon render them out of date, and ordinary folk are not always buying furniture. On the other hand, a catalogue, accurately priced, of electrical goods would be kept for a much longer period, and would almost certainly be used. Of course, small electrical retailers cannot contemplate any colossal distribution of printed matter of this sort, but even if a big complete catalogue cannot be indulged in, they would find it advantageous to publish and circulate occasionally among their customers printed lists of selections from their stock.

The designing of an electrical retailer's catalogue is an art in itself. It differs in many respects from the manufacturer's catalogue, being governed by different rules and requirements. Even the least impressive list of prices calls for a good deal of mental concentration and practical skill to make sure that it will serve its purpose properly.

Two main principles must be observed. Any electrical retailer's catalogue must be produced with maximum economy. Secondly, it must devote itself to selling the goods with which it deals. The householder must be compelled or coaxed to keep it by him for purchasing; but, in addition, he must be made to regard it as essentially truthful, and he must be led to feel the want of the goods it describes so keenly that, as soon as he or she can afford it, these goods are purchased. Every page, every illustration, every sentence, every item of arrangement, must inspire the belief that the goods are well worth the money asked for them. Therefore the catalogue should include full particulars of any guarantee given with electrical appliances, whether proprietary or otherwise, or with any other goods stocked; and this guarantee should be made prominent by printing it in bold clear legible type. The electrical retailer must use his own judgment on the subject of reproducing testimonials. When these are too extravagant in character, they are likely to do more harm than good. On the other hand, a sensible, straightforward, obviously honest piece of third-person appreciation always carries weight with the reader.

When illustrations are employed, these should exactly reproduce the goods stocked. They should not be faked to make the goods look better than they actually are. Stock blocks of standard fittings and appliances can often be bought cheaply from agencies, but it is always an advantage to use one's own, if the expense can be borne. Many manufacturers will, on request, gladly lend the retailer suitable half-tones, line-blocks, or woodcuts, of their specialities.

It is always advisable to mention the fact, if a limited stock of a particular line is carried. This prevents and explains a possible disappointment. At the same time, it is bad policy to declare that only a limited stock is carried, when this is not true. For every person who hastens to purchase the commodity offered in the belief that otherwise he will be too late, there is another who will not purchase because he feels certain he will be too late in any case.

Every page of the electrical retailer's catalogue should be a good page-advertisement. This is more than a mere exhortation, a ringing phrase. In Press advertising, every inch of space has been purchased with good money, and is therefore valuable. Every inch of space in the catalogue should be looked upon in the same light. Now, here comes in the difference between the manufacturer's catalogue and the retailer's. In the former, white space has a value all its own, and it pays the maker to use plenty of it in his advertisements and catalogues. In the latter, however, this law seems to have no power, and white space becomes almost waste space. What would in the one case be inefficient overcrowding becomes in the other efficient crowding.

If good, clear types are used, it does not matter how much one packs into a retail catalogue page, electrical or otherwise. Of course, the pages must be attractively displayed and well balanced, but this is taken for granted. Every inch, then, should be filled with illus-

trations and facts. The pictures need be no bigger than is requisite to give an idea of the appearance of the articles offered. The descriptions should be strictly truthful, in both letter and spirit, and should be as graphic as possible consistent with brevity and accuracy. The types employed should not be larger than the size known to printers as eight point, this being sufficiently large for ordinary textual purposes. Where the details are less important, six point can be used. Types larger than these need be used for display or emphasis only; for instance, where it is desired to stress the price of an article, or to point out the excellence of the guarantee. Customers are chiefly interested in two points, with both of which the retail catalogue can deal; first, the cost of the goods offered; secondly, what they will do or save. The customers know pretty accurately what they can afford to give for what they need. If the price is reasonable, a sale will probably ensue. If the reasonable price is accompanied by a satisfactory guarantee, this probability becomes almost a certainty.

While the writer has urged the employment of as much space as possible, it must not be assumed that he suggests excessive overcrowding of the pages, so that the reader's eye becomes dazzled or fatigued. The retailer in doubt how to arrange his pages should observe the close connection between pictures and letterpress in good retail advertisements. He will attain his object also by selecting only the clean and graceful types of which so many now exist. This is not difficult. He should examine the advertisement pages of the first-class weeklies and dailies, cut out specimens of the types that please him, and send these to the printer with instructions to match them. In this way, a good deal towards securing a compact, economical page will have been done. There is no need to choose too costly a paper for the catalogue, as is often done by inexperienced retailers. Papers with a quite good finish and appearance can be obtained that do not weigh nearly so much nor cost so much as the expensive papers that printers often try to palm off on their customers. The safest plan is to have a chat with the printer, get him to pick out the lightest papers that will adequately reproduce the blocks it is intended to use, and then make the final selection oneself from the samples submitted.

This matter of choosing the right paper is most important, and equally so is the arrangement of the text. In a retailer's catalogue of electrical appliances and fittings, it is seldom advisable to print the costly goods more prominently than cheaper goods of the same or a similar character. It may, sometimes, be advantageous to give greater prominence to electric washers than to copper wire; but it is not wise to give greater space and larger illustrations to the high-priced valve set than to the lower-priced one. They should both be catalogued and illustrated in the same manner, their prices being printed in types of identical size. The reason for this is that when the higher-priced set is given greater prominence than the lower-priced one (assuming them to be the same in character, *i.e.*, two four-valve sets, not a four-valve and a two-valve, where the difference in price is immediately explicable) the householder who can only afford the lower-priced set is apt to imagine that it is a cheap and nasty second-rate sideline, not worth the price demanded for it.

The cover of the electrical catalogue needs a little attention, and in particular demands good judgment and taste. It should make a quiet appeal to the reader's eye, not startle and repel by its meretriciousness. A crude and gaudy cover suggests cheap-jack business methods, and this is the last impression the electrical retailer should seek to convey. A suggestion of permanence should be given, if possible; some intimation that the catalogue is meant to be kept for reference may conveniently be worked into the cover design.

The thickness and strength of the cover paper will, of course, depend upon the number of pages, but too heavy a paper should be avoided unless postal expense is negligible. It is astonishing how much money can be economised by choosing carefully in this respect.

If the catalogue is distributed postally, it should be sent either in an envelope or in a wrapper. The wrapper is the cheaper method, because, since it is open at both ends, it can go by book post at a lower rate than if sealed in an envelope. This warning would seem superfluous but for the fact that retail catalogues continue to reach the writer sealed up in envelopes, on which an unnecessarily heavy postage has been paid.

Of course, if a personal communication accompanies the catalogue, the full postage rate must be paid, but stereotyped or machine-duplicated letters can, if arrangements are made beforehand with the postal authorities, be enclosed with the catalogues and sent at the cheaper rate. Before this can be done, a sample of the catalogue, the proposed duplicated letter, and the wrapper or envelope, should be sent to the nearest post office with a request for definite permission in writing to send them at the cheap rate. The electrical retailer must not cause his customers to pay excess postage. They will never forgive him for that.

The Electric Welding of Metal.

(*Abstracts of papers read before the* INSTITUTION OF WELDING ENGINEERS.)

INTERESTING information concerning the operation of welding is afforded by the examination of the micro-structure of the deposited metal and the material adjoining the weld. Some account of such matters is contained in the recent short paper by Mr. H. H. Abram, M.Sc., F.Inst.P. (of the Research Department, Woolwich), who exhibited photomicrographs taken from butt- and lap-welded medium-carbon steel plates, but the features described are common to all cases of arc-welded steel.

Microstructure of Arc-Welded Steel.

It is shown that the heat affected the structure of the plate to a maximum depth of 0.1 in. The heat of the arc or the first contact of the deposited metal with the plate heats the surface of the plate to a temperature considerably above the Ac_3 change point, which is immediately followed by rapid cooling, and results in the formation of a coarse overheated structure, showing less free ferrite than the normal material. The subsequent effect is to heat this coarse layer again above the Ac_3 point. This time, however, the temperature does not rise so high, with the result that the grain is refined.

This suggests that the metal first deposited is refined by the subsequent reheating through the critical range to which it is subjected as additional layers of metal are deposited. As no additional metal is deposited on the surface layers which are air cooled right down from the melting point, the cast structure persists at these positions.

The microstructures described are typical, and indicate certain features which unfortunately preclude the existence of ideal mechanical properties in welded objects. The deposited weld metal being in the cast condition is essentially brittle, while its carbon content is frequently very low, a fact which imposes a limit on the tensile strength. Failure of a welded structure often occurs, however, not through the weld itself, but through the adjacent metal which has suffered from the deleterious effects of the high temperature involved in arc welding. Improvement can be affected by normalising or annealing the whole welded object when practicable, this treatment also serving to relieve any internal stresses which may have been set up by the welding operation.

The structure of the surface layers of the deposited metal, after normalising at 950 deg. C., shows the original cast structure to have given place to grains of ferrite containing numerous needles of iron nitride, which are not removed by the normalising treatment, are more prevalent in the surface layers of the deposited weld metal than in the interior, and their presence makes for greater brittleness of the metal.

Resistance Welding.

The aim of the paper by Mr. F. E. Saunders, M.I.E.E., is to give a *résumé* of resistance welding in general. He explains that resistance welding, whilst not having so many applications as arc welding, offers many advantages, of which the foremost is economy of electrical energy. In addition, it does not occasion the electrical and heat losses involved in d.c. and a.c. arc welding, and no flux is employed.

When a.c. arc welding with a transformer a choke coil is sometimes used instead of a non-inductive resistance; the loss due to the latter is then not apparent, but the power factor may fall as low as from 25 to 35 per cent., a fact which appears frequently to be ignored. With resistance welding a.c. is invariably transformed to from 2 to 4 volts and applied direct to the surfaces to be welded.

In the arc-welding processes at present in use, only from 25 to 45 per cent. of the electrical energy does effective work, whereas in resistance welding about 80 per cent. of the energy is used effectively. The above comparisons are not intended to suggest that arc welding can always be dispensed with. What is claimed is that when the work can be brought to the machine and is of the repetition type, resistance welding is more economical, more efficient, and the more effective. The advantages of resistance welding appear to have been neglected. However, each process has its special applications to which it is the more suitable.

Resistance welding comprises three processes, *viz.*: Spot, seam, and butt welding; in addition, the transformer can be utilised for rivet heating and tempering, &c.

The various forms of resistance welding are dealt with; illustrations of the machines and details of their manufacture are given, together with some suggestions as to the general application of such machines to the various fields of work; also reference is made to three typical photomicrographs of spot and butt welds, and to their metallurgical details.

For spot welding, the two electrodes, which are kept cool by an internal water supply, are fitted with points proportionate to the capacity of the transformer and suitable for the thickness of the metals operated upon. If this is not carefully effected the heat of resistance spreads over too big an area and results in defective penetration. It is practically essential that the current should be switched off before the release of mechanical pressure, and all machines should be fitted with a device for this purpose, either in the form of a trip-switch or a current limiter.

If a dead flush fit is not established in butt welding, it is advisable for the current to be cut off to allow the heat to distribute itself before the final pressure is applied. The operation should then be repeated as many times as is necessary to get the ends uniformly plastic. If the heat be not uniformly distributed a bad weld results, as part of the butt being plastic and part semi-plastic, a homogeneous weld will not be produced. It is due to the recognition of this weakness that flash welding has been developed. Theoretically, a direct butt weld should be absolutely satisfactory, but as in practice so much time has to be employed to establish a true face, flash welding is commercially the more effective. Also flash welding causes the minimum of "upset" and is therefore preferable. The excrescence or "upset" should not be hammered out, but should be cut or ground off.

Flash welding is much the same as direct butt welding, excepting that the adjustment of the jaws is controlled by gear wheels, which secure a very slow movement to allow the butts, which are always out of truth, to be burned to a true square surface before contact. The rate of bringing together the jaws is ascertained visually by watching the sparks thrown out. If the approach is too rapid, sparking ceases and the edges become red hot as in butt welding. In such an eventuality the jaws are immediately released and the process repeated more slowly. If the approach is too slow, sparking becomes intermittent and the heat produced is insufficient to cause plasticity. Immediately the faces are burned true the butts heat evenly all over and are ready to be welded.

Spot welding is advantageously used by manufacturers of such sheet iron articles as would otherwise be riveted or bolted; it does not reduce the strength of the metals, and whenever the work can be brought to the machine, provided it is limited to a maximum thickness of, say, ¾ in., spot welding is a far more economical proposition than riveting. Seam welding has a much smaller field of application than spot welding, due to its limited capacity for satisfactorily welding any thickness above ordinary thin sheet iron or steel. It is generally understood that seam welding is not effective when the added thickness of metals exceeds ¼ in. There is a great demand for the seam welding of small tubes by the resistance process, but a satisfactory machine has not yet been designed for this purpose. All material must be of special quality with no scale, failing which ordinary sheet iron or steel must be prepared by pickling. Given satisfactory metals and conditions of work, the results obtained are exceptionally good, and the advantages of this process, within its limits, far outweigh those of any other method at present in use.

The paper contains tables and charts showing the cost of operation and speed of work of the various methods of electric welding, and it should be emphasised that the author's intention is not in any way to overstate the advantages of resistance welding compared with other forms, but rather to point out that this branch has been neglected.

Discussion.

Mr. H. S. JEFFS, discussing the statement in the paper that in resistance welding the uneven contact between two adjacent metallic surfaces provided a resistance to the passage of electricity sufficiently high to heat the metals to the required temperature, contended that the heat was due more to the resistance in the work itself rather than to bad contact between the two metallic surfaces, because bright steel plates could be spot-welded to give a contact which was absolutely perfect. Technically, single-phase supply was necessary, but in practice not absolutely, because on polyphase systems an electric welding machine could be used so long as they could bring two leads to the machine itself. Mr. Jeffs did not agree that seam welding was not effective when the added thickness of the metals welded exceeded ¼ in., *i.e.*, that it was not practical to seam-weld two plates each more than 1/16th in. in thickness; he believed that in this country they could now seam-weld greater thicknesses. Another statement made in the paper, with regard to butt welding, was that the jaws of the machine should grip the work as nearly as possible to the welded junction. His view was that, as the resistance of the work across the gripping jaws, or between the electrodes, produced the heat necessary for welding, it was sometimes necessary to have quite a large distance between the jaws themselves and the ends of the work being welded together. This was particularly necessary in the case of copper, because it was a very low-resistance metal and they must have a distinct length of copper protruding from the jaws of the machine to enable the copper to heat up quickly with the minimum of current in order to make the job economical. Mr. Jeffs agreed that cleaning the rollers of a seam-welding machine was a troublesome job, but the current was now controlled in such a manner that the minimum of oxidation was set up in the material welded, so that the rollers did not pick up the material so freely as it travelled through them, and the rollers required cleaning much less frequently.

Mr. W. L. LORKIN, dealing with the author's remark that resistance welding had been neglected in this country, said he hoped he had considered the fact that they in this country were greatly handicapped by the various types of supply; a great many authorities only supplied direct current.

The CHAIRMAN (Mr. A. L. Haggerty) asked the author if he had any information with regard to the application of large butt-welding machines to the welding of tramway and railway rails.

Mr. SAUNDERS, in reply, said that he had pointed out in the paper that when material thicker than the dimensions he had given had to be welded, it was necessary to introduce outside pressure in order to get a good weld. He agreed that the extensive use of d.c. in this country was a great drawback, but he believed the supply authorities were changing over as quickly as possible to a.c. If a user had only d.c. he must have a rotary converter, but for the ordinary three-phase or any other a.c. supplies there were special transformers and special machines which would not increase the cost of putting down the plant very much. He believed that butt-welding machines had been used for welding tramway and railway rails some time ago, but that the practice was not very successful. The great trouble was that they had to bring the machine to the work, and the heavy sectional area of the copper conductors for welding a section of a tramway rail was almost prohibitive.

Birmingham Library.—Birmingham now has its technical library in connection with the Corporation Central Library, and on Monday, December 1st, it was formally opened by the Lord Mayor (Ald. Percival Bower). The new library is a parallel department to the Commercial Library which was opened five years ago in the Birmingham Council House, Great Charles Street. The commercial library (like the new technical library) was actually an extension of the reference library, and the former has proved an unqualified success. Already the need for a larger room is apparent. In view of the experience in connection with the commercial library, the Libraries Committee has taken the first opportunity of providing a technical library, the distinction being that the commercial library is intended primarily to serve men who place goods on the market, and the technical library to meet the requirements of those who manufacture them. The latter has been fitted up in oak, and contains about 4,000 volumes, transferred from the reference library.

Electric Smelting of Iron in Norway. — Some time ago reference was made in this journal to the experiments made by Mr. Tysland, a Norwegian engineer, on behalf of the State, in the direction of the electric smelting of iron at Fiskaa by means of furnaces devised in that country. It is now announced that the Norsk Blikvalseverk (tinplate rolling mill) has passed into the hands of a new company which will work in conjunction with the Christiania Spigerverk (nail factory), whose works are being converted as from next spring for the electric smelting of iron. The energy will be obtained from the Akers electricity works and a contract has been entered into for 5,000 kW. The method which has been worked out by experiments is said to permit of the use of cheap raw materials and also of the waste products of the nail works.

The Institution and its Members.

Abstract of Chairman's Address: SOUTH-MIDLAND CENTRE.

MR. W. LAWSON, M.I.E.E., delivered his inaugural address as chairman of the South-Midland Centre of the Institution of Electrical Engineers, at Birmingham, on October 22nd. It was divided into two parts: one concerned three special metering problems, and is being amplified with a view to its publication as a separate paper. The other portion was of general interest and is abstracted below.

Such ideas as the author submitted were of the order of by-products of the activities in which he had been concerned as a meter engineer, as management secretary of a Whitley works committee of the Birmingham Corporation electricity undertaking, and as a member of the Institution.

If one was satisfied with merely statistical evidence, then it was easy to claim that the Centre was in a flourishing condition. The present membership, including that of the Sub-centre, numbered 936, as against 421 in 1913. Such figures spelt progress, but they did not reveal the more obscure vital factors representing the amount of interest taken by each individual member in the affairs of the Centre and its future development, and what his conception was of the part to be played by it in furthering the prestige and influence of the whole Institution.

It was extremely desirable that more papers should be forthcoming from amongst their own members, so that all available special knowledge and talent would be disclosed. In that respect much good would result from the establishment of co-operation between the various centres and sub-centres, and by bringing them into closer touch. It was all a question of whether they were content as a body to function mechanically on set lines, or wished to intensify their interests and extract the last ounce from every privilege of membership.

One matter concerning which statistics were not flattering was the Benevolent Fund. Last March the then President issued a circular in which he stated that from a total of 11,500 members a sum of £636 10s. in donations and subscriptions was received. That worked out at an average for the year of 1s. 1¼d. per member.

They had been criticised as a body for their inability to advance the material interests of their members and, in spite of all modern tendencies, they had, through sheer weight of tradition, resisted the temptation to become protective in character. If they were frank they must admit that under existing conditions that could be a handicap in individual cases, but in promoting the advancement of electrical engineering science the Institution did indirectly foster the interests of the electrical engineer; that, however, did not denote any question of the reality of its ethic of "service" implied in its constitution. It would be absurd to suppose that its members were not influenced by prevailing currents of feeling and that it was sterilised of all forms of self-interest, so it did well to preserve its best traditions.

The Institution should be better known amongst all thinking sections of the public who, if they were aware of its existence, merely regarded it as a body responsible for keeping a register of qualified electrical engineers. The time was ripe for someone to write the history of the Institution of Electrical Engineers. Intrinsically the Institution was richly endowed with possibilities of impressing its character on the minds of those who would take a leading part in the period of reconstruction which ultimately must follow the present difficult and distracting time of industrial rehabilitation. Within it were men in divers positions trained to methodical investigation and, moreover, capable of practical judgment, to whom they should look for some contribution to the solution of their difficulties.

It was a matter of practical, rather than theoretical, consideration. It was within the scope of the Institution to take its part as an educational body and to the subject of "works management" might be added "economics and industrial organisation." A student would be infinitely better equipped for his future work and advancement if he possessed a knowledge of the design and objects of such machinery as existed for the adjustment of the differences and relationships between employers and employés. He should know something of the history of trade associations and also of trade unions, so that when the time came to take a hand in such matters he would be properly fitted for it. The Institution could not hold aloof from those problems of human organisation which were the concern of and affected a large proportion of its members, to whom it should, if it could, be a source of instruction and guidance.

The general outlook was far from encouraging; the deplorable fact remained that their industries had not settled down to a united effort to get to grips with their difficulties. The materialism which possessed the national soul and the extraordinary spread of the spirit of combination permeating all classes of the community were the principal factors in a fierce movement towards fostering sectional, rather than public, interests. In conflicts between Trade Unions and Employers' Associations the evil effects of the movement gained the chief publicity, but an equally serious, if less conspicuous, resultant was the multiplicity of trade organisations which were too prone to extract from the community such rewards for their services as accorded with their own valuation. It was the suppression of the better part of their purpose that constituted the leading modern error of many societies. Self-interest could not be eliminated, but it could be directed to useful and beneficent ends; indiscriminately exercised, it induced violent reactions and opposition, and led to recurring dislocations, in the adjustment of which the factor of satisfaction was a negligible quantity. Therein lay one of the greatest and most urgent problems of the day.

Another matter of grave concern was that eternal "kink" in the relationships between employers and employés which originated with the introduction of the factory system and the inevitable estrangement between the two partners in production. The Whitley Works Committee was a simple and practical means of getting down to the bed-rock of the problem. The electrical industry had grown to be counted amongst the great industries of the world, and it was certainly the most modern. It was therefore demanded of it that it should aim at being the best organised industrially. The fetish of collective action had resulted in the suppression of the sense of personal duty and responsibility, and concentration on the obtaining of a maximum reward for services rendered had tended towards the making of individual valuation. They were all in danger of developing into the type of person who had been described as "knowing the price of everything and the value of nothing."

Electrical Trade of Australia.

Imports and Exports.

THE following figures, showing the values of the imports of electrical and allied goods into Australia in 1922-23 are taken from the recently-published official trade returns. Where comparison is possible figures for 1921-22 are given, and notes of increases or decreases are made:—

	1921-22. £	1922-23. £	Inc. or dec. £
Dynamo-electric machines, static transformers, induction coils, electric fans, and parts thereof—			
Total	1,349,000	1,136,000	– 213,000
From United Kingdom ...	689,000	725,000	+ 36,000
,, United States	606,000	338,000	– 268,000
Regulating, starting, and controlling apparatus—			
Total	349,000	528,000	+ 179,000
From United Kingdom ...	227,000	243,000	+ 16,000
,, United States	120,000	281,000	+ 161,000
Electrical fittings, viz., switches, fuses, and lightning arresters—			
Total	217,000	216,000	– 1,000
From United Kingdom ...	118,000	121,000	+ 3,000
,, United States	93,000	87,000	– 6,000
,, Japan	5,000	4,000	– 1,000
Electric heating and cooking appliances—			
Total	16,000	21,000	+ 5,000
From United Kingdom ...	6,000	9,000	+ 3,000
,, United States	9,000	8,000	– 1,000
Electrical appliances, other—			
Total	696,000	478,000	– 218,000
From United Kingdom ...	354,000	255,000	– 99,000
,, United States	223,000	179,000	– 44,000
,, Netherlands	98,000	1,000	– 97,000
,, Denmark	1,000	8,000	+ 7,000
Telephone apparatus			
Total	386,000	458,000	+ 72,000
From United Kingdom ...	155,000	211,000	+ 56,000
,, United States	215,000	214,000	– 1,000
,, Sweden	7,000	5,000	– 2,000
Cable and wire, covered—			
Total	888,000	1,208,000	+ 320,000
From United Kingdom ...	860,000	1,188,000	+ 328,000
,, Japan	4,000	—	– 4,000
,, United States	22,000	13,000	– 9,000

The figures for the 1922-23 financial year are given in greater detail than in the preceding 12 months. Thus the total above-mentioned of £1,136,000 of electrical machinery, fans, &c., is shown to include the following:—

	Total. £	Including from U.K. £	U.S. £
Dynamos	949,000	645,000	241,000
Fans	41,000	16,000	17,000
Transformers and induction coils	146,000	64,000	80,000

Sweden supplied dynamos to the value of £35,000 in 1922-23.

Again, the £458,000 worth of telephone apparatus is made up as follows :—

	1921-22.	1922-23. Inc. or dec. Including from	
	Total.	U.K.	U.S.
Telephones	196,000	114,000	59,000
Telephone switchboards, distributing boards and appliances	262,000	97,000	155,000

The covered cable and wire to the value of £1,208,000 comprised a small quantity of cotton covered material, nearly all supplied by the United Kingdom, £239,000 worth of lead-covered, paper-insulated telegraph and telephone cable, all from Great Britain, and £953,000 worth of other cable and wire, nearly all from Britain.

Another reclassified item in the 1922-23 statistics is lamps and lampware which appear in the 1921-22 imports to the value of £283,000, with Japan as the principal supplier. The later record is: Lamps, filament, for lighting and heating, total £368,000; United Kingdom, £173,000; Netherlands, £123,000; United States, £36,000.

Measuring and recording instruments are stated separately, total imports being £176,000, of which £119,000 worth came from the United Kingdom.

In the 12 months under review, gas and oil engines were imported to a total value of £238,000, compared with £189,000 in 1921-22. The new classification permits of the following comparison :—

	Total.	Including from U.K.	U.S.
Type.	£	£	£
Gas	69,000	62,000	7,000
Diesel	2,000	2,000	—
kerosene, petrol, and other light spirit	167,000	94,000	60,000

It is also shown now that steam turbines were imported in 1922-23 to the value of £25,000 (United Kingdom £21,000), and steam engines, other than portable or traction, to the value of £83,000, practically all from the United Kingdom.

Export trade in Australian-made electrical machinery, appliances, and materials has dwindled from £88,000 in 1920-21 to only £8,000 in 1922-23.

Legal.

British Thomson-Houston Co., Ltd., v. Charlesworth, Peebles & Co.

THE opening stage of this House of Lords appeal was reported in our last issue. The hearing was continued on December 4th.

SIR DUNCAN KERLY, K.C., continued his address for Charlesworth, Peebles & Co. (the appellants), and said he entirely disputed that there was anything to discover after 1906. Lord Buckmaster said counsel was concerned to show that nothing else had been protected.

SIR DUNCAN agreed, and added that he wanted the House to appreciate what had been done in this case. His opponents had left out of the picture 1906 matters altogether, while they created an atmosphere in which they produced again all that had been done before 1906. Before 1906 they did not know that this could be done.

LORD HALDANE said that, as he understood it, the contention was that the 1909 specification for the first time put the practical way of working things known before, so that they could be made a commercial success.

SIR DUNCAN said if there was a different sort of working that must be sufficiently defined in the specification. He referred to .the evidence given by Dr. Oberlander, who being asked if directions were given in 1906 to enable lamp filaments to be obtained by the working of tungsten, and if there was not by implication a direction to work the tungsten repeatedly, replied "All working is repeated working." He was further asked whether it was possible by a single working to get any metal reduced in cross section or diameter from, say, pencil size to filament size, and replied, "No, there were gradual reductions in the various steps." Again, Professor Gray said that the subjecting of a thing to various operations of different kinds and steadily reducing the diameter, as by hammering followed by wire drawing, would be called repeated working.

SIR DUNCAN then drew attention to the 1909 specification and said there were very minute instructions as to the ordinary working, but was there anything that the ordinary person would not know? He suggested that only a very skilled person with a great amount of experience, could do all this at all, and they were told that they must go with great care. At the trial in Scotland his clients attempted to submit certain evidence, but it was not allowed, and the Inner House held that the question had not been properly brought before them, and refused to admit the evidence.

SIR DUNCAN then proceeded to read the judgments delivered in the Scottish Courts, commencing with that of the Lord Ordinary (Lord Blackburn). This, together with the judgments of the First Division extended to great length, and was continued on December 5th. Lord Blackburn had said that the pursuers had succeeded in establishing the validity of the patent so far as four claims were concerned. The fifth claim incorporated the apparatus described on pages 7 and 10 and shown in the diagram attached to the specification. Figure 1 merely showed an apparatus for heating the dies used in the operation of drawing by means of a gas jet; figure 2 was another apparatus for the application of heat to the rod as it entered the swager. Both figures were subjected to the same criticism that they were entirely lacking in novelty. Figure 3 was an illustration of a swaging machine which possessed some novelty in the shortening of the mechanical hammers so as to avoid more than one blow falling on the same part of the metal during one process of working. Had the claim for the apparatus not been qualified by the words "for manufacturing wires or filaments of tungsten ductile at ordinary temperature," he did not think he could have sustained it. But qualified and restricted as it was, it appeared to him to be unobjectionable for similar reasons to those which he had given in dealing with the known methods which went to the making up of the process as a whole. With respect to the question of infringement, it was maintained that the pursuers had failed to prove that the filaments complained of had been constructed in accordance with the directions in the patent. The evidence for the pursuers tending to show that the patent had been infringed was confined to this: that they had proved that the filaments in the lamps sold by the defenders were fibrous, and they maintained that there was no other known process by which such a product could be obtained than that set out in their patent. The pursuers' evidence was certainly not more than sufficient to establish a *prima facie* case of infringement, and, had the lamps been manufactured in this country, that would not have been sufficient to entitle them to decree. But the lamps complained of were manufactured abroad, and accordingly this *prima facie* evidence of infringement was sufficient to throw the onus on the defenders of proving that they were not manufactured in accordance with the process described in the patent. In his opinion the defenders had failed to discharge the onus, and he accordingly sustained the validity of the patent and granted interdict. Having read the judgments of the First Division, Sir Duncan next read the judgment delivered by Mr. Justice Russell in the English case in which the British Insulated & Helsby Cables, Ltd., were concerned (see ELEC. REV., February 8th, 1924, p. 209), and the further hearing was adjourned until December 10th.

Charges Against a Foreman.

AT Manchester Assizes on November 20th, Harold Abrahams, a foreman, was charged with stealing £107, and 15 cwt. of electric cable valued at £60, and falsifying the accounts of his employers, Messrs. Watshams, electrical engineers, while engaged on a contract at Eagley Mills. Regarding the third charge, it was stated that the prisoner induced workmen to sign blank time sheets and then filled them in to make it appear that a considerable amount of overtime had been worked. Over £300 had been paid by the firm in this way, although only overtime to the value of £60 could be accounted for.

In sentencing the prisoner to 18 months' imprisonment, Mr. Justice Mackinnon said that he would not take the first two charges into account, as these would probably be dealt with in London.

A Trade-Mark Action.

MESSRS. MORRIS ASHBY, LTD., have sent us a copy of a judgment by Mr. Justice Eve obtained by the Barber Asphalt Co. against Meade-King Robinson & Co., Ltd. This records an undertaking by the defendants not to sell or otherwise to describe as "Gilsonite" any asphaltum or asphaltic materials not obtained from the plaintiffs, and not to infringe in any other manner plaintiffs' Trade Mark No. 225,233. It is ordered that defendants shall pay the taxed costs of the action. All further proceedings are stayed.

Holophane, Ltd., v. G. H. Smallwood & Co.

IN the Chancery Division on December 2nd and 4th, this case came before Mr. Justice Lawrence.

MR. OWEN THOMPSON, K.C., in opening the plaintiffs' case, said the action was brought by the plaintiffs for an injunction to restrain the defendants, who carried on business as electrical engineers and electrical contractors at Shrewsbury, from passing off as the plaintiffs' goods, goods which were not in fact theirs.

The defence was that there had been no passing-off. The "Holophane" shades prevented glare and threw the light in the most efficient way. The passing-off alleged in the present case occurred in the course of the installation of electric light in St. George's Church, Shrewsbury, which had been previously lighted by gas. In November, 1922, tenders were obtained for the lighting from Messrs. Thomasson & Co. and from the defendants, and the specification provided for "Holophane" shades. The defendants' tender was accepted, and when the work was completed plaintiffs discovered that not one "Holophane" shade had been put in, but that the shades actually supplied were of cheap foreign manufacture. Upon this coming to the plaintiffs' knowledge they wrote to the defendants for an apology for what had been done. To this they replied that they had not told anyone that the shades

fixed were "Holophane" and that the shades that were then fixed were only there temporarily. It was then insisted that "Holophane" shades should be put in, and this was eventually done.

Mr. G. H. Smallwood, a partner in the defendant firm, gave evidence to the effect that the foreign shades were only fitted temporarily and that the church authorities had been informed of their use.

At the conclusion of the evidence and the addresses of counsel, Mr. Justice Lawrence said that the decision to which he unhesitatingly came was that the defendants had no intention of passing off the shades as "Holophane" shades. Mr. Smallwood had written a letter to the architect which he meant to be an intimation of the action which he had taken and he certainly informed one of the churchwardens that he had put up temporary shades. The action would accordingly be dismissed with costs.

A Telephone Fraud.

At Bow Street Police Court, on December 5th, William Beaver Lounds, Ealing, was charged with the fraudulent consumption of electricity by inserting metal disks in a telephone call apparatus, and, further, with the theft of 4d. An inspector said that he noticed that the defective coin aperture of a machine at Charing Cross Station had been blocked with a wad of paper. A watch was kept on the box, and the defendant was seen to enter. When he left the paper had been removed and two metal disks which the inspector had left in the box had been used. The defendant said that when he removed the wad the two disks and four pennies fell into his hand; he used the disks inadvertently to make the call. He had no intention of defrauding or of stealing the money.

Sir Chartres Biron said that he was sorry that he could not see any doubt in the case, and imposed a fine of £5 on each charge.

British Thomson-Houston Litigation.

An appeal came before Mr. Justice Russell in the Chancery Division, on December 5th, on a summons to vary a Master's certificate certifying that the British Thomson-Houston Co., Ltd., was entitled to recover £500 damages from Messrs. Goodman's (Leeds), Ltd., and Mr. Henry Goodman and his wife, for infringement of the plaintiffs' letters patent 10,918 of 1913, in respect of gasfilled lamps. Judgment for an injunction had previously been entered by consent against the defendants, with an order for delivery up and an inquiry as to damages, defendants having admitted the sale complained of.

Defendants' case was that they were only jewellers, and received the lamps from a Mr. Walker, who owed them £30 for rent. Mr. Goodman, on an order for affidavit, stated that there were 39 lamps in defendants' possession open to inspection, which were not an infringement of the patent.

Mr. Bennett, K.C., for the appellant defendants, said he was at a loss to know on what the Master based his award of £500.

Mr. Trevor Watson, for the British Thomson-Houston Co., said that the defendant Goodman, in his billheads and his own handwriting, was offering lamps in gross lots, and there was reference to "h.w. lamps." Counsel suggested that he had deliberately withheld information that he was bound to give the Court.

Giving judgment, Mr. Justice Russell said that if the defendant had withheld information that he ought to have communicated to the Court, still the Court, in assessing damages, should have something to go upon. At 2s. a lamp, £500 meant 5,000 lamps. If he allowed Mr. Watson what he had argued for, he found only 63 lamps. Defendant certainly made an order to supply a considerable quantity of these infringing lamps. Mr. Watson suggested that the Court should presume everything against the defendant. His Lordship was unable to take that view, and decided to reduce the damages from £500 to six guineas, and Mr. Watson was granted leave to appeal from that decision.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

Commercial Engineers.

I note from an announcement in your valuable paper of the 5th instant that efforts are being made to form an Association to cater for commercial travellers and representatives in the electrical trade.

May I be allowed to point out that the National Association of Supervising Electricians already caters for a section of the employés concerned, namely, "Commercial Engineers," who must be technical men with experience and qualifications in accordance with the Association rules for full membership?

The N.A.S.E. has always adopted the policy that commercial engineers, *i.e.*, technical travellers or representatives, should have a sound technical knowledge of the trade, and is of the opinion that it is in the interests of all concerned that representatives should be able to discuss with a client the technicalities of a particular job. Not only does this save time by obviating the necessity of having to refer technical questions to the works or technical departments, but it assists in smooth working.

I realise that it is not generally known that the N.A.S.E. does include commercial engineers in its membership, which may be the result of the dislike of the Association for self-advertisement.

A. Brammer,
General Secretary, National Association of Supervising Electricians.

London, *December 5th*, 1924.

A New Market.

I was unaware that British manufacturers were exporting transformers to Jupiter, Mars, and other neighbouring bodies, but a recent circular letter would appear to imply that this is the case. In announcing the commencement of transformer manufacture by a new company, the circular states: "The design and management are under the control of engineers with extensive experience, and whose designs have already given satisfaction to numerous users throughout the *universe*" (italics mine).

Surely this is trade revival with a vengeance!

A Mere Earthworm.

December 6th, 1924.

British Municipalities and Foreign Electrical Plant.

I should be grateful if you would again allow me a little of your valuable space to reply briefly to the letter of "Manufacturer" in last week's issue.

With regard to the discoveries made during my peregrinations, I shall say no more at present than that I was engaged for some time with one of the leading B.E.A.M.A. firms in comparing costs with ring prices, and either there was a colossal margin of profit, which somehow or other was not reflected in their balance sheets, or the cost sheets were in such a chaotic state that no true conclusion could be drawn. The latter would serve to confirm my statements with regard to the lamentable lack of organisation of some of our leading firms.

"Manufacturer" seeks to elaborate his argument with seasonable references to Santa Claus and snowballs without, however, cutting much ice. If his knowledge of economics is as great as his knowledge of geography, he is to be congratulated on a rare achievement. But so busily has he occupied himself in studying foreign fiscal arrangements and labour conditions, that unfortunately he has overlooked an important flaw in the statistical material at his disposal. One would imagine from his letter that foreign countries are dumping goods into Great Britain without taking anything in return, and that by means of tariff walls they are protecting their industries. But what are the facts?

The following figures are taken, not from a Bolshevik organ, but from the *Daily Mail Year Book* for 1925, pages 110 and 111, representing the exports and imports of manufactured goods from and into Great Britain for the latest available year, *viz.*: 1922.

Articles wholly or mainly manufactured.

	Imports in £.
Consigned from foreign countries	207,085,000
Consigned from British Possessions	22,664,000
	Exports in £.
To foreign countries	316,547,000
To British Possessions	251,976,000

Thus, so effectively do foreign tariffs operate, that we are able to send goods to foreign countries 50 per cent. greater in value than we get from them! So much for tariffs as a guardian of foreign industries!

Whereas international commerce demands a *quid pro quo* "Manufacturer" demands, as a Lancastrian would say, a "quid for nowt."

He sighs for a tariff. Having erected a ring round the municipalities (why he leaves the company undertakings severely alone he does not say) he now longs to build a Chinese wall as an additional safeguard, so that he can ask municipal engineers to gaze out of the window and admire the delightful prospect.

"Manufacturer" apparently labours under the delusion that municipal engineers, not having fallen over themselves to reply to his article, are overwhelmed with his arguments. There are times, however, when silence is golden. We venture to assert that "Manufacturer," before many days are over, will appreciate this adage.

Salesman.

December 6th, 1924.

The letter which you published from Mr. A. Morris in your issue of the 5th instant seems to me to answer itself, or, at any rate, to suggest spontaneous replies.

He says that my article was full of complacent self-interest and fallacies. As regards those alleged fallacies to which Mr. Morris draws attention, I will deal with them later in detail, but I would like to remark that the article was written from

the manufacturer's point of view and necessarily concerns itself mainly with that aspect. An endeavour was made, however, to show that the interests of municipal engineers were closely allied to those of manufacturers.

No specific reference was made to the Newport job, neither am I aware of the details. I am, nevertheless, prepared to assert without fear of contradiction from any competent authority that the placing of a £30,000 engineering contract in this country would result in one week's employment for not less than 7,980 persons in various trades. This is a statement of fact and has no flavour of the "sob stuff" to which Mr. Morris makes reference.

Mr. Morris's next point is that since the loss of our foreign markets is an important cause of our unemployment problem, the best way to recover our foreign markets would be to lose the home trade as well. I really cannot put it any other way, for Mr. Morris says "the action of Newport will tend to encourage this revival." The truism of commerce that exports pay for imports does not take the time element into account, nor does it say in what way the payment will be made. Granted, that if Newport spends money in Switzerland we may at some time or other get it back through various channels; but it should be borne in mind that it will probably travel round the world three times before it comes home—*i.e.*, the spending of money by Newport in Switzerland will most certainly decrease Swiss unemployment at once, but cannot react on British unemployment for a very considerable period, and it is highly probable that some of the money which comes back to us by devious paths will be in such a form as not to be available for industrial purposes except after re-investment. I think that the proverb: "A bird in the hand is worth two in the bush" applies to the case stated by Mr. Morris.

I cannot deal properly with the details of the Newport case which Mr. Morris next refers to, because I do not know the facts, and I have no opportunity of looking them up before the next issue of the REVIEW goes to press, but taking the figures which Mr. Morris quotes I would present the case as follows:—

The Newport Budget.—Instead of spending £30,000 in Great Britain a saving of £13,000 is effected by Newport ratepayers.

The National View.—If £30,000 had been spent at home, labour would have benefited to the extent of not less than £24,000 and in addition approximately £7,890 would have been saved by taking that number of persons off the dole for one week.

The National loss is £31,980, less the £13,000 saved by Newport, *i.e.*, £18,980, without counting the benefits to the nation of the odd £6,000 which would have gone in overhead charges and profits to the manufacturers.

There are other ways of presenting these figures, but whichever way it is done the net result is a gain to Newport and to Switzerland and a loss to British labour in 1924-5. If all municipalities acted in the same manner the country would undoubtedly be in a very bad way.

Not being a municipal engineer, Mr. Morris cannot be blamed for not knowing the trouble which was experienced by many central stations during the war through having foreign plant in use for which they were unable to get spare parts and renewals. He will surely admit that in times of war it is desirable to maintain the supply of electricity in order to be able to manufacture warships, guns and munitions.

Criticism has been directed against the high wages which are being paid by certain Borough Councils to their dustmen. I presume Mr. Morris would deal with this situation by discharging the British dustmen and employing, say, Chinese labour, which could doubtless be obtained for half the money. He would then be able to argue that he had rendered a service to British unemployed because the savings which the Chinamen sent home to China would eventually come back in the form of payment for British commodities.

Why not look the facts straight in the face? British wages, salaries, taxation, rent, beer, and whisky, are relatively high, and under these conditions it is quite impossible for British manufacturers to maintain their high standard of quality and at the same time to compete in price with certain foreign competitors. Time and circumstances will probably modify the conditions in due course and by gradual stages. Meanwhile it is in the national interest that at any rate the Government Departments and public bodies should be prepared to pay higher prices for British manufactures rather than to endeavour to wreck our industries and increase the numbers of the unemployed.

Manufacturer.

December 8th, 1924.

International Radio Week—Evening Transmissions.

May we beg your readers while the impressions are still fresh in memory to forward brief reports on the quality of reception they experienced of the 10.30—11.30 p.m. transmissions, and whether such reception was

(*a*) Direct from the country broadcasting;
(*b*) *Via* the B.B.C. relays.

Observations, opinions, and criticism (especially constructive) are invited, since such comment will be invaluable.

Out of deference to the expressed wish of the B.B.C., practically no preliminary publicity was given to the institution of these evening transmissions. Consequently great numbers of the public are doubtless quite unaware of the aims and objects of the movement, and it may be desirable here to mention that the aim is to bring nations into closer touch by means of national programmes broadcast by each country in turn for the benefit of other participating countries. Such programmes, containing, amongst other items, addresses by leading personalities, native music by native composers, and other material peculiar to the country broadcasting, will, it is hoped, tend towards the creation of better international understanding and goodwill.

These transmissions must not be confused with the 3—5 a.m. scientific tests, with which they have little in common. The evening transmissions were designed for the purpose stated, rather than for their scientific value, and were arranged so that even the crystal-user might enjoy a "glimpse" of foreign lands.

All communications will be welcomed—even a line on a postcard.

Clifford & Clifford,
Hon. Secretaries, The Wireless Retailers' Association.

70, Finsbury Pavement,
London, E.C.2, *December 3rd*, 1924.

The Moderate Powered Direct-coupled Back-geared Motor.

We have read with interest Mr. Taffs's letter, which appears in your issue of November 28th, and can fully confirm that roller bearings, when properly designed, will satisfactorily withstand the vibration of a gear drive, as all our experience proves this.

We have many instances of Cooper roller bearings running satisfactorily with gear drives for 10 years or more, and can quote instances of roller bearings of 16-in. internal diameter giving every satisfaction with gear drives, under very rough conditions where vibrations and shock are very prominent.

With regard to traction work, Mr. Taffs limits his remark to motors, but there is no reason why the use of roller bearings should not be extended to the main axles, with corresponding reduction in the starting current and cost of power.

The Cooper Roller Bearings Co., Ltd.,
C. A. ABLETT, *Managing Director.*

King's Lynn, *December 1st*, 1924.

Assessments.

We understand that the assessors for the counties of East and Mid Lothian, and also for the city of Edinburgh, intend to increase the rateable value of all premises where electricity has been installed, the argument being that a house or premises so equipped is more valuable in the market than one served by gas. While this may be a good advertisement for electricity, we find the prospect of increasing rating in some cases operates adversely against the industry, as intending consumers are chary of installing electric light, and thereby incurring increased assessment. The proposition does not seem equitable, because one is penalised if in this way the household equipment is added to, and, further, it is debatable whether in some cases where gas was reverted to the rateable value would be reduced to its former figure.

We should be glad if any of your readers could give us information as to whether any similar practice is in vogue elsewhere.

The Lothians Electric Power Co.

Musselburgh, *December 1st*, 1924.

Turkey as a Market for Radio Apparatus.

I was much interested in the letter of Mr. L. F. Fogarty appearing in your issue of November 28th, 1924. On observing the possibilities of establishing a broadcasting service in Turkey, one is met with distinct difficulties of various kinds. Mr. Fogarty stated that inquiries were being received in this country for the shipment of multivalve sets. The use of multivalve sets in a country such as Turkey is surely restricted to a very small portion of the total population. In Turkey, I understand, our British workman, who is quite capable of operating his crystal or valve set, is represented by an individual who is semi-nomadic. It seems therefore that broadcasting is not an institution that would appeal to the Turkish proletariat, in which case it is not likely to meet with any great success. Again, only persons of wealth could afford expensive and elaborate receiving equipment, and since such persons in Turkey are not over abundant, evidently no substantial trade in radio apparatus could be satisfactorily maintained. Mr. Fogarty also makes reference to the issuing of instructions to outlying and remote villages. What instructions? Surely the instructions that these villages receive are not of such vital importance as to warrant their transmission by radio-telephony? Somewhat deviating from the point, but if these instructions were issued by radio it is quite within the bounds of possibility that they would not be executed with anything like the efficiency that would obtain if they were transmitted by messenger.

The establishment of a broadcasting station in Turkey by British manufacturers appears attractive at first sight, but it is obviously a proposition faced with prodigious difficul-

ties. Should such a scheme be put before the Turkish Government by manufacturers of another Power, in my humble opinion the British would be the last to whom they would wish to grant concessions. The unfortunate little affair in Iraq some while back must not be forgotten.

Dallas G. Bower.

Tidal Power and Windmills.

In your issue of November 14th there is an illustration of a tidal-dam (page 726) which seems to me to be a modification, for the worse, of the ancient *Forge-Catalane* described by Pernolet in *L'Air Comprimé* nearly 50 years ago, and, still earlier, by de Romilly—who fully investigated the possibilities of such apparatus.

This going back to an old device is on a par with Dr. Haldane's suggestion that we should use windmills for electric lighting; and when tide is out, and there is no wind, we can depend on "Storage"!

Mr. Underwood has very kindly offered to arrange for my having a look at some of the hydraulic plants, so I may write you thereon later; but, in the meantime, may I be allowed to put on record this expression of my doubts as to the efficiencies claimed?

Wm. H. Massey.

Twyford, Berkshire, *December 1st*, 1924.

Business Notes.

The Christmas Holidays.—The ELECTRICAL REVIEW for December 26th will appear one day in advance of the usual time of publication owing to the Christmas Holidays. The attention of advertisers is therefore called to a notice appearing in our advertisement pages to-day. Alterations to existing trade advertisements must be received by Wednesday, December 17th, but copy for Official Notices, Situations Vacant, &c., will be in time if delivered at 4, Ludgate Hill, E.C., by 5 p.m. on Monday, December 22nd.

Correspondents and other contributors to our editorial pages are also requested to bear the earlier publication arrangements in mind and to forward their articles and news items without delay.

Bankruptcy Proceedings.—R. D. BARNS, dealer in radio accessories, late of 160c, Finchley Road, Hampstead, N.W.—The first meeting of creditors was held on December 4th at the London Bankruptcy Court, when accounts were presented showing liabilities £620 against assets valued at £31. According to the debtor's statements he started as a motor engineer with a capital of between £300 and £400, and traded with success for two years, when business became slack. Early last year he began business as a dealer in radio accessories, but that trading was a failure from the outset, and he closed the business when he had disposed of the stock. Bad trade and illness were the causes assigned for the failure. In the absence of any offer the case remained in the hands of the Official Receiver to be wound up in bankruptcy. The following are the principal creditors:—

	£		£
Burndept, Ltd.	28	Radio Communication Co., Ltd.	36
Bower Electric Co., Ltd. ...	21	Metropolitan-Vickers Electrical Co., Ltd.	22
Cranes Firework Co., Ltd. ...	96		
C. F. Elwell	33	Rd. Melhuish	20
General Radio Co., Ltd.	82	H. W. Sullivan, Ltd.	124

F. H. P. HOOLAHAN (trading as Holloway Bros.), electrical engineer, 209, Holloway Road, N.—The public examination of this debtor was held on December 6th at the London Bankruptcy Court. The receiving order was made on August 19th last on the debtor's petition and he has lodged accounts showing showing total liabilities £341 (unsecured £261) and assets £49, absorbed in a claim for rent. The debtor stated that with £30 capital, he began the business of an electrical engineer and instrument maker. He attributed his insolvency to lack of capital, losses sustained in connection with experimental work, foreign competition, and general trade slackness. The examination was concluded. The following are the principal creditors:—

	£		£
Dawkins, H. J.	36	United Flexible Metallic Tubing Co., Ltd.	25
General Electric Co., Ltd. ...	35		
Hoolahan, E. P.	20	Fully secured creditors	30
Keith & Blackman Co., Ltd. ...	48	Preference creditors	53

W. T. ROBINSON and H. ATTERBY, trading as J. P. Beckett and Co., 134, Victoria Street, Gt. Grimsby, electrical engineers.—The public examination of these debtors was held on December 4th at Grimsby. The statement of affairs showed ranking liabilities of £1,528, and there was a deficiency of £415. Debtors attributed their failure to depression in trade, bad debts, and want of capital. It appeared that they started trading in partnership in May, 1922, purchasing for £450 an existing business. A balance sheet for the year to May, 1923, showed a net profit of £582, but there had since been a loss of £123. The examination was adjourned.

ARTHUR WOOD, 67, Bradford Avenue, Great Grimsby, electrical agent.—The public examination of this debtor was held on December 4th. According to the statement of affairs there were liabilities of £322 and a deficiency of £283. Debtor attributed his failure to bad trade and bad debts. It was stated that he commenced business in February, 1922, at Grimsby, with a borrowed sum of £1,500, of which £700 had since been repaid. No claim for the balance had been made. He became aware of his position in April, 1924; he, however, carried on business for another four months. The examination was adjourned.

H. D. ZEALANDER and S. DAVIS, trading as S. Davis & Co., electric lamp dealers, 226, Bishopsgate, E.C.—The public examination of these debtors, who failed last October on the petition of the British-Thomson Houston Co., Ltd., creditors for £70, was held on December 3rd. The debtor Zealander stated that he and Davis commenced the above business in December, 1923, each of them providing £20 as capital. They were fairly successful, but in March, 1924, actions were brought against them by the petitioning creditors for an injunction restraining them from infringing a patent; judgments were given against them, and on March 25th, as a result thereof, they closed the business. They had no other liability beyond that above mentioned and they possessed no assets whatever.

Questioned by Mr. W. M. STABLE, who represented the petitioning creditors, the witness said that before starting the business of Davis & Co. he was in the employ of D. Rose and Company, against which firm proceedings were also brought for infringing electric lamp patents. After Davis & Co.'s business was closed down witness became interested in a business carried on as "The Z.W. Trading Co."

MR. STABLE: May I take it that for some time past your business has consisted of infringing the patents of my clients?—Not since we had an injunction given against us in the action.

Then, when you are found out and legal proceedings are taken, you start precisely the same business under another name?—No.

Have you done that three times within the last twelve months?—No.

You know that legal proceedings were taken against D. Rose and Co.?—Over one patent.

Precisely, and judgment was recovered?—I don't know about judgment. I left soon after the proceedings were started.

Then you start exactly the same game under the name of S. Davis & Co., and when judgment is recovered against them you set up this company styled the Z.W. Trading Co. (Minories), Ltd., and when proceedings are taken against it you resign your directorship of that concern.

The debtor added that he was now carrying on business at St. John's House, Minories, as H. D. Zealander, dealer in wireless accessories.

The debtor Davis stated, in reply to the Official Receiver, that before joining the last witness in partnership he and another person started business in 1921 as electrical contractors at 40, Osbourne Street, E., under the style of "Stoddart and Davis." That partnership was dissolved after ten months' trading owing to differences; he retired and was thereafter engaged on electrical installation work on his own account.

The examination of both debtors was concluded.

J. B. SHIELDS, master plumber and electrician, 198a and 221, Linthorpe Road, Middlesbrough.—Receiving order made November 28th, on debtor's own petition. First meeting, December 12th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, January 16th, at the Court House, Middlesbrough.

F. P. CRAWLEY, electric, radio and motor-car engineer, &c., New Central Garage, 30, Mincing Lane, Blackburn.—Trustee, Mr. A. T. Eaves, 15, Fountain Street, Manchester, appointed December 1st.

J. KINGSTON (Cromwell Engineering Works), electrical and general engineers, 176, Romsey Road, Shirley, Southampton.—Receiving order made November 27th, on debtor's own petition.

E. E. CLARK, electrical engineer, late of 4, Alhambra Buildings, Lancashire Street, Morecambe.—First meeting, December 12th, at the official Receiver's offices, 11, Winckley Street, Preston; public examination, December 12th, at the Sessions Hall, Preston.

Company Liquidations.—COMMERCIAL ELECTRICAL ACCESSORIES, LTD.—The statement of the Liquidator (Mr. Norman Bell) shows that a dividend of 15s. 6d. in the pound has been paid to creditors. Realisation of the assets was effected without recourse to auction, and the results, in the opinion of the committee, are very satisfactory.

ELECTRICO, LTD.—Winding up voluntarily. Liquidator, Mr. P. G. Wheatley, 102, High Street, Poole.

PORTA RADIO, LTD.—Winding up voluntarily. Liquidator, Miss M. A. Heyburn, 61, St. James Street, S.W. A meeting of creditors was called for December 11th. Particulars of claims to be sent to the Liquidator by January 1st.

Dissolutions of Partnership.—P. NUTTER & SON, electrical engineers and merchants, 41, Side, Newcastle-on-Tyne.—Mr. P. Nutter and Mr. C. S. Atkinson have dissolved partnership. Mr. Nutter will attend to debts and continue the business.

KINCAID, WALLER, MANVILLE & DAWSON, civil and electrical consulting engineers, St. Stephen's House, Westminster, S.W. —Mr. J. E. Waller, Sir Edward Manville, Sir Philip Dawson, Mr. A. E. Jackson, and Mr. H. G. Simmonds have dissolved partnership on the retirement of Mr. J. E. Waller from the partnership. Sir E. Manville, Sir P. Dawson, Messrs. Jackson and Simmonds will attend to debts and continue the business under the old style.

Trade Announcements.—PREMIER ELECTRIC HEATERS, LTD., is erecting a new building at its site in Keeley Street, Birmingham, which will practically double the works floor space.

MESSRS. CHARLES CHURCHILL & CO., LTD., have ceased to represent the Norton Co., and have entered into an agreement with the Carborundum Co., Ltd., to co-operate in the provision of "Carborundum" and "Aloxite" grinding wheels.

The electrical department of MESSRS. GRIMSTON, PRICHARD AND PLUITE, LTD., is now being carried on by a separate company—the Central Cables & Accessories, Ltd., whose registration was recorded in our last issue.

The works and organisation of BULL MOTORS, LTD., of Stowmarket, are shortly being removed to Ipswich. Messrs. E. R. & F. Turner having taken over the business in its entirety.

The offices of the AIREDALE ELECTRICAL & MANUFACTURING CO., LTD., are now at 392, Bowling Old Lane, Bradford.

Catalogues and Lists.—THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—Leaflet No. L.332, describing "B.T.-H." headphones, and a mailing-card calendar advertising "Mazda" lamps.

THE MILLNS ELECTRICAL CO., 17, Whitefriars Street, E.C.4.—An illustrated booklet describing "Meco" electrical organ-blowing equipment.

MESSRS. R. H. LONGBOTHAM & CO., LTD., 22, Northumberland Avenue, W.C.2.—A priced and illustrated pamphlet advertising "Inventum" electric fires with plugged-in elements.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—December price list of electrical appliances, materials, and accessories.

MESSRS. L. MCMICHAEL, LTD., Hastings House, Norfolk Street, Strand, W.C.2.—A circular letter advertising the firm's radio components, priced in some instances, and a leaflet dealing with sets of h.f. transformers in cases.

MESSRS. DUFF BROS., 10, Rangoon Street, E.C.3.—A pamphlet dealing with "Celatsite" insulated tinned-copper wire of round section. Also a card bearing samples of this with coverings of different colours for radio work.

DELCO-REMY & HYATT, LTD., 56, Victoria Street, S.W.1.—Two illustrated leaflets describing, respectively, bearings for light truck and trolley wheels and power-driven crane wheels.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A well-illustrated and priced list of "Sunco" radio sets and parts, and a leaflet dealing with distribution fuse boards.

ECONOMIC ELECTRIC, LTD., 10, Fitzroy Square, W.1.—A priced and illustrated catalogue of radio sets and accessories.

HENRY JOSEPH & CO., LTD., 96 & 100, Victoria Street, London, S.W.1.—Illustrated and priced leaflet dealing with the "Klutch" wireless terminal.

WALKER VEHICLES, LTD., Caxton House, Westminster, S.W.1.—An illustrated brochure dealing with the "Railodok" service at the British Empire Exhibition.

THE WHOLESALE FITTINGS CO., LTD., 23-27, Commercial Street, E.1.—A well-illustrated catalogue containing details and prices of "Supastone" glassware electric lighting fittings. Also a pamphlet illustrated in colour advertising the "Flora" illuminated fruit and flower baskets.

MESSRS. FALK, STADELMANN, LTD., 83-87, Farringdon Road, E.C.1.—A very comprehensive catalogue (248 pp.) of lighting fittings of all kinds, metal and glassware, standards, brackets, bowls, shades, statuettes, lanterns, &c., with copious illustrations and prices. The publication also contains a few pages devoted to radio receiving sets and accessories, and domestic appliances.

THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—An illustrated pamphlet dealing with the company's oil separators for the treatment of exhaust steam.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta172, describing the company's oil-sealed calcium chloride "breathers" for transformer tanks.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex.—Lists Nos. 326 and 328, dealing, respectively, with "Sparta" headphones and the "Sparta" one-valve amplifier. Illustrated and priced.

CHARLES WHITE ELECTRICAL CO., LTD., 26, Upper Thames Street, E.C.4.—A priced leaflet illustrating six designs of electric light lanterns.

THE AIREDALE ELECTRICAL & MANUFACTURING CO., LTD., 392, Bowling Old Lane, Bradford.—Leaflet No. 24/4, dealing with air-break star-delta and series-parallel starters.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Pamphlet No. 233, containing illustrations and descriptions of 37 different types of radio valves made at the Osram Lamp Works, with characteristic curves of each type. The publication bears a price of 5s.

Social Event. — A new club house for the workmen of Vickers & International Combustion Engineering, Ltd., at Barrow-in-Furness, was opened by the works manager, Mr. J. S. Snape recently. Mr. Snape made an appropriate speech, dealing with the benefits and formation of the club, and mentioned the help and encouragement that had been generously given by the firm. The workmen provided entertainment in the way of piano selections, songs, and games, &c.

Calendars and Diaries.—RADIO INSTRUMENTS, LTD., has sent us a handsome calendar for 1925 bearing monthly date slips and a reproduction of the portrait of a dark-eyed beauty ("Juanita").

The same company has also sent us a Letts "wireless" diary for 1925 containing, in addition to the daily memoranda pages, a great deal of information regarding radio practice, including a number of standard receiving circuits.

A wall calendar with the months of 1925 unobtrusively printed in small figuring below a charming coloured view of "Erith Reach" (showing the company's works) has been received from Callender's Cable & Construction Co., Ltd., of Hamilton House, Victoria Embankment, E.C.4.

Illustrations of the firm's mining specialities and a block of large-figured date slips are the features of a calendar received from MESSRS. HEYES & CO., LTD.

Book Notices.—Special Report No. 2 of the Radio Research Board, "Variation of Apparent Bearings of Radio Transmitting Stations—Part I, Observations on Fixed Stations, February, 1921—March, 1922." 96 pp. and key map. London: Stationery Office. Price 3s. 6d. net.

"The Wheatstone Telegraph System," Technical Instructions V of the Post Office Engineering Department. London: H.M. Stationery Office. Price 3s. 6d. net.—This excellent production, containing 53 pages of text, two appendixes, and 92 illustrations and diagrams, commences with a general description of the Wheatstone telegraph system—perforators, transmitters and their adjustment and action, and receivers being dealt with in the first four sections. Connections and lay-out of apparatus are next discussed, methods of obtaining speed at simplex operation and duplex working are explained, and speed tests also receive attention. The staff required is enumerated, the limitations to speed of working are outlined, and vibrating relays are dealt with in Part XII, the last section being devoted to the subjects of inductance and capacity.

"The *Journal* of the Junior Institution of Engineers." December, 1924. London: Percival Marshall & Co. Price 2s.—In addition to the reproduction of papers, this issue contains reports of visits, and the annual general and other meetings.

Publications of the Massachusetts Institute of Technology. No. 39, "Transformer Harmonics," and No. 40, "Transmission Line Transients." Massachusetts: The Institute.

"Technology Reports of the Tohoku Imperial University." Vol. IV, No. 2. (60 pp.) Tokio: Maruzen Co., Ltd.

"Will's Law Relating to Electric Lighting, Power and Traction." Fifth edition. By J. C. Dalton. Pp. xlii+441 and index. London: Butterworth & Co. Price 42s. net.

"Electric Circuits and Installation Diagrams." By W. S. Ibbetson. Pp. vii+186; 175 figs. London: E. & F. N. Spon, Ltd. Price 10s. 6d. net.

"A Wise Fool." By E. C. Reed. Pp. vi+320. London: John Long, Ltd. Price 7s. 6d. net.

"Michael Faraday." By W. L. Randel. Pp. 192. London: Leonard Parsons, Ltd. Price 4s. 6d. net.

British Machinery Trade.—In the November issue of the *Bulletin* of the British Engineers' Association the current financial and trade statistics relating to the production, export, &c., of the British machinery and allied trades are summarised, and from these curves have been prepared to indicate the main tendencies of trade.

A Foreign Light Railway Concession.—The holder of a concession to construct a 22-mile light railway abroad is at present in this country. He wishes to get into touch with contractors and others who may be prepared to take a financial interest in the scheme. Communications should be addressed to the Service Department, Electrical Review, Ltd.

E.D.A. Activities.—The British Electrical Development Association has produced an "album" of advertisements, "electros" of which may be obtained for a very reasonable sum. The publication consists of eight long pages, and contains reproductions of 45 advertisements, touching all phases of electrical development, and suitable for use in newspaper and magazine advertising.

Engineering Workers' Wages.—A meeting of a committee representing the 41 trade unions concerned in the recent application for a weekly increase of 20s. in the wages paid to workers in the engineering industry was held at York on December 3rd. Consideration was given to the form of the reply which is being made to the employers' statement when refusing to grant the increase, and it was decided to hold a full meeting of the unions in York on Thursday (yesterday).

The employés of three firms—Messrs. Baldwins, Ltd. (Blackwall), Messrs. Lancaster (Bow), and Thermit, Ltd. (Battersea)—recently anticipated further national negotiations by striking for an increase of 10s. per week.

"Relay" Telephones for Berlin.—The Relay Automatic Telephone Co., Ltd., has received an order from the Minister of Posts and Telegraphs, Berlin, to supply private branch automatic exchange apparatus built to the same specification as the "Relay" installations supplied to the British G.P.O.

Greenock Undertaking's Semi-Jubilee.—The electricity undertaking has recently celebrated its semi-jubilee, having been inaugurated in November, 1899. The original plant consisted of two 150-kW Belliss-Silvertown sets, a 100-kW balancer set, and two motor boosters, and during the first complete year only 157,681 kWh was sold. The present plant comprises about 20,000 kW of turbo plant, apart from secondary plant, of which there is a great deal. The original scheme was drawn up by Mr. S. E. Fedden (who is now at Sheffield); he was followed in 1900 by Mr. Nelson. In 1902 Mr. J. A. Robertson took over the plant, and Mr. Whysall, who is the present engineer, succeeded Mr. Robertson in 1914.

A Radio Apparatus Display.—A special window display of "Siemens" loud-speakers and headphones is being made at the premises of the Siemens & English Electric Lamp Co., Ltd., Upper Thames Street, E.C.4. The headphones are put up in very attractive presentation boxes, bearing a "Nightingale" design in blue and white on the lid, whilst round the side is a series of artistic panels, illustrating listening-in in its various phases. The "Nightingale" showcard is also displayed, and in fact provides the dominant *motif* of the decorative scheme, in which blue and white are the only colours employed.

The Cardiff Engineering Exhibition.—The engineering exhibition, which was held in Cardiff from November 27th to December 6th, under the auspices of the South Wales Institute of Engineers, is now apparently to be an annual event. Messrs. Page & Stibbs were the official electricians to the show, and amongst the exhibitors Messrs. David Ashton and Co., Ltd., Messrs. Blackstone & Co., Ltd., Messrs. Brecknell, Munro & Rogers, Ltd., and the British Electric Plant Co., Ltd., showed machinery suitable for mines. The British Flottmann Drill Co., Ltd., had an M.-L. pneumatic electric mining lamp on view, while miners' lamps were also exhibited by the "Ceag" Miners' Supply Co., Ltd., and several other firms, and the "Clifton" continuity mining armoured lighting system was shown by the Central Electrical Co. (Nottingham), Ltd. Batteries, of course, were exhibited by the Chloride Electrical Storage Co., Ltd., and the "Derby" miner's pillarless electric lamp was to be seen on the stand of Messrs. John Davis & Son (Derby), Ltd., two-part dry battery lamps and lamp-room equipment being shown by the Federation Lamp Co. Messrs. Gent & Co., Ltd., had on view mine telephones and signalling apparatus, the Harland Engineering Co., Ltd., showed switches and fuses, Messrs. Haslam & Stretton, Ltd., displayed a range of electrical colliery appliances by various makers, and instruments. Other exhibitors were: Messrs. J. H. Holmes & Co., Messrs. Honeywoods, Ltd., Messrs. Mavor & Coulson, Ltd., the Mining Engineering Co., Ltd., Messrs. Oldham & Son, Ltd., the Rheostatic Co., Ltd., Messrs. Strachan & Henshaw, Ltd., Messrs. E. Thomas & Williams, the Thor Electric Safety Lamp Co., Ltd., and the Wolf Safety Lamp Co. (Wm. Maurice), Ltd.

Tramway Employés' Wages.—A report upon the recent Wages Award has been presented by the Manager (Mr. J. C. Whiteley) to the South Shields Tramways Committee. He states that the award will involve an increase of £1,000 per year. He points out that South Shields has been placed in Group No. 1, although larger towns have been placed in lower groups. A motorman in Shields is to receive 63s. 6d. per week, but in Jarrow, which adjoins, a motorman will receive only 57s. 6d. per week, and inter-running powers are in operation between the two towns. The Committee recommends that an appeal be made for the undertaking to be placed in Group No. 2.

The Sunderland Tramways Committee, which is not a party to the National Wages Award, is recommending an increase of 2s. per week in the wages of inspectors, motormen, conductors, handymen, and cleaners, and 1s. a week for conductors under 21. This will bring motormen up to the highest rate in Grade 1 under the Award, but the other classes of workmen will be below the highest rate. The Committee also agreed to restore the eight days' annual holiday with pay, instead of six days.

Australian Trade Commissioner.—Mr. R. W. Dalton, Senior Trade Commissioner in Australia, has taken new office premises at Henty House, Little Collins Street, Melbourne.

Tramcar Competition in Luxemburg.—Tenders were recently received in Luxemburg for the delivery of 25 motor cars and 10 trailers, offers being sent in by German and other foreign works. According to a Luxemburg correspondent, the list of tenders for the mechanical parts of the cars shows that the German firms quoted the highest prices. It is stated in this connection that the Belgian Customs tariff, which also operates in Luxemburg, has had an unfavourable effect upon the German tenders, and that this explains why Germany is endeavouring to secure concessions under the negotiations for a new commercial treaty with Belgium and Luxemburg.

Unemployment.—The Employment Exchange returns for the week ended November 24th showed a total of 1,190,400 wholly unemployed persons. This was 18,599 less than the previous week's figure, and the decrease since the beginning of the year has been 95,223.

Poland's Electrical Imports.—According to the *Board of Trade Journal* the latest available monthly impoft figures, those for May last, show that the value of instruments, conductors, and other electrotechnical apparatus imported was 1,987,000 zloty (over £80,000).

The Argentine Radio Apparatus Market.—According to *Commerce Reports* the radio apparatus market in Argentina is dull owing to the existence of large stocks that could not be disposed of during the summer slump. The future, however, is encouraging as there is no sign of falling off in the enthusiasm for radio-telephony. The United States supplies about 90 per cent. of the imported radio apparatus, but the market, it is said, has only reached about 60 per cent. of the saturation point.

Local Exhibitions.—WAKEFIELD.—The Electricity Department made good use of the City's Health Week Exhibition, which was open from November 24th to 29th. Its exhibit was organised chiefly as introductory to a hiring scheme for cookers and washers, and the task of placing these and other appliances was rather one of instruction and demonstration than of persuasion. The health and labour-saving virtues of electricity in domestic service are not questioned; what people want to know is how it works and what it costs. To answer these and other questions, Mr. J. H. Firth, of the Sales Section, laid out his stand so as to include a model kitchen and a showroom. In the first were a "Western Electric" washer and wringer and plate washer, a "Jackson" wash boiler, a "Genii-Vectis" bath-water heater, and "Tricity" appliances, including cookers. Demonstrations were given by lady demonstrators. A miscellany of domestic fittings was on view in the showroom. Among these were home motors, irons, toasters, &c., and there was a "Singer" electric sewing machine. The artistic possibilities of electricity for lighting purposes were evidenced in the whole appearance of the stand, coloured lamps and shades being used to excellent effect.

BRADFORD.—The promoters of the *Yorkshire Evening Argus* radio and electrical exhibition, which is to be held at the Belle Vue Drill Hall, Bradford, from January 3rd to 10th, 1925, have sent us a prospectus. Firms interested in this matter should communicate with the British Industrial Exhibitions, Ltd., 73, King's Arcade, Bradford.

PAISLEY.—Under the auspices of the Corporation Electricity Department an electrical exhibition and demonstration was opened on December 2nd. Mr. W. Blair Smith, the Corporation electrical engineer and manager, was responsible for the arranging of the stalls. At the opening ceremony it was stated that in two and a half years there had been supplied under the Corporation hiring system 450 radiators, 60 domestic cookers, and 50 time switches for after-hours' window lighting.

PRESTON.—A Trades Exhibition is being held at the Public Hall, Preston. Several stands are devoted to electrical appliances and radio accessories. The exhibitors include Messrs. Edwd. Dewhurst, Ltd., Messrs. Mears, Messrs. Bradshaw, and Messrs. Marsden.

SLAITHWAITE.—The Urban District Council is to hold an exhibition of electric lighting, domestic, and other appliances at the Liberal Hall, from December 16th to 20th, inclusive.

Italian Lamp Imports.—The Italian import returns for the first half of the current year show that the number of lamps purchased abroad remained at about the same level—5,919,600, as against 5,768,000 in the previous year (first half). The bulk of these lamps came from Holland, and the German and Austrian shares increased.

The Spanish Electrical Market.—*Commerce Reports* says that the present building "boom" in Spain has created a demand for all kinds of domestic appliances, including electrical fittings. These are being supplied mainly by English and German manufacturers, while several native companies have also been started.

Electricity Supply Workers' Wages.—At a meeting of the District Industrial Council (No. 5), West Midlands Area, for the Electricity Supply Industry, at Birmingham, on December 5th, it was jointly agreed that wages for all adult employés should be increased by 2s. 6d. per week, this being the restoration of the amount deducted in February, 1923. This arrangement, which is subject to ratification by the National Council, was to take effect after the pay week following December 1st.

Leeds Radio Retailers.—Owing to the prevalence of price cutting, Leeds radio apparatus dealers are contemplating following the example of the Bradford radio distributors in forming a local organisation of dealers under the city's Chamber of Trade.

American-European Lamp Agreements.—Agreements have existed for some years past between the Siemens & Halske Co., the A.E.G., the German Incandescent Gas Light (Auer) Co., and the Julius Pintsch Co. (which are embodied in the Osram Company) on the one hand, and the American General Electric Company on the other, with regard to the production and sale prices of metal-filament lamps. It is now stated that representatives of these interests have recently had repeated discussions with, among others, makers in Czechoslovakia and Austria, with a view to their coming into the scheme, that these have already led to favourable results, and that agreements with other countries are to follow.

Pulverised Fuel Contracts.—Among recent orders received by VICKERS & INTERNATIONAL COMBUSTION ENGINEERING, LTD., for "Lopulco" pulverised fuel installations are the following:—St. Pancras Borough Council, second installation, including two Vickers-Spearing boilers; Synthetic Ammonia and Nitrates, Ltd., two Thompson boilers and "Lopulco" equipment; and the Holborough Cement Works, Kent, pulverised fuel installation for two rotary kilns supplied by Messrs. Vickers, Ltd.

Lighting and Power Notes.

Ashford (Kent).—SPECIAL ORDER.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the town and to parishes in the areas of the East and West Ashford Rural District Councils. It is proposed to erect a generating station in the vicinity of the Cattle Market.

Bath.—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £5,200 for the provision of a new boiler.

Berkhamsted.—ELECTRICITY SUPPLY.—The Rural District Council has given its consent to the application of Aylesbury Corporation for a Special Order to supply electricity within the rural area. The Council has been informed that it is proposed to commence extending the supply to Wiggington, Aldbury, and Berkhamsted rural as soon as the legal formalities are concluded, probably by the end of 1925 or early in 1926. The charges for electricity will probably be 25 per cent. above the Aylesbury rate, and connections will be free of charge.

Bingley.—NEW SUB-STATION.—On November 29th, the foundation stone of the new sub-station for the Urban District Council, in connection with the supply from Keighley Corporation electricity department, was formally laid by the chairman of the Lighting and Tramways Committee. The new sub-station will replace that set up in 1914 when the supply to Bingley was commenced, and will be capable of carrying three times the load of the old station. It has been designed to permit of further extensions as necessary to meet future requirements.

Cheltenham.—ELECTRICITY SUPPLY.—The borough electrical engineer has submitted to the Electricity Committee a preliminary plan and estimates of the cost of transmission lines for the supply of electricity in the North Gloucestershire area (east of Severn), and a trunk transmission line from Cheltenham to Gloucester, also the cost of changing over the system of supply from single- to three-phase, which will be necessary if the scheme is carried out. The committee has recommended that the estimates be submitted to the Electricity Commissioners for approval subject to a Government grant being obtained toward the cost of the scheme. It was stated at a recent meeting of the Electricity Committee that the Gloucester city electrical engineer was preparing estimates of the cost of transmission lines to the North Gloucestershire area (west of Severn) and of a proposed power station.

Colwyn Bay.—ELECTRICITY ORDER.—The Urban District Council is applying to the Electricity Commissioners for an Order authorising it to supply electricity in the parishes of Penrhyn, Llangwslenin, Llansantffraid, and Glan Conway. The estimated cost of the Penrhyn Bay scheme is £5,441, and that for Glan Conway £3,027.

Continental. — CORSICA. — Plans are in progress for the establishment of a large hydro-electric plant near Ajaccio for the supply of power to that district. It is proposed to construct a dam across the river Gravona and thereby form a storage reservoir. The estimated cost of the scheme is 2,200,000 fr.

AUSTRIA.—Begun in 1903, the large hydro-electric power station of Partenstein was recently formally inaugurated. The station is situated in the Grossen Muhl, where a reservoir has been constructed giving a fall of 183 metres. The equipment consists of three 15,000-h.p. Francis spiral turbines, each coupled to a 12,000-kVA generator.

Greenock.—INTERLINKING.—In order to provide the Paisley Corporation with a bulk supply of electricity, a joint scheme has been drawn up under which Greenock and Kilmarnock Corporations will supply Paisley separately or together, at the same time making it possible for supplies to be interchanged between each other. A 22,000-volt transmission line, of which 13½ miles is overhead and three miles underground, has been built and the scheme was officially inaugurated on December 4th, when advantage was taken of the occasion to mark the 25th "birthday" of the Greenock Corporation's electricity undertaking.

Halifax.—LOAN SANCTIONED.—In connection with the Corporation's application for a loan of £43,000 for mains, transformers and switchgear, the Electricity Commissioners state that they are not yet in a position to deal with the application as a whole, but have sanctioned the borrowing of £13,000 for transformers and switchgear.

Hawarden.—LOAN.—The Rural District Council has applied to the Electricity Commissioners for sanction to a loan of £25,000 for carrying out an electricity scheme.

India. — ELECTRICITY SCHEMES. — Good progress is being made in the development of public electricity supply undertakings in the Punjab and it is expected that Multan and Rawalpind and possibly Lyalpur, will shortly be provided with a supply. Improvements in the existing distributing system at Lahore and Amritsar are also contemplated.

Irish Free State.—KINGSTOWN (CO. DUBLIN).—Good progress in being made with the installation of the electric lighting scheme in the district. The cables have been laid, and the lamps for public lighting placed in position. Though the power station is not yet completed, one of the engines has been erected, and a satisfactory test carried out. It is expected that the scheme will be in operation before the end of the year.

Lancashire.—ELECTRICITY SUPPLY.—There have been joint conferences of the Fylde coast electricity undertakings of Blackpool, Lytham St. Annes, and Fleetwood regarding the future development of electricity supply in the area, and a special sub-committee has been appointed to open negotiations with Preston Corporation respecting a bulk supply of electricity to Blackpool Corporation.

Lancaster.—UNEMPLOYMENT SCHEME.—With a view to providing work for the unemployed, the Electricity Committee has recommended to the Town Council that extensions to the distribution system be carried out in the Scotforth, Bowerman, Bulk and Skerton districts at an estimated cost of £13,700, and that application be made to the Electricity Commissioners for sanction to borrow the necessary sum to carry out the scheme.

LOAN SANCTIONED. — Sanction has been received from the Electricity Commissioners to the borrowing of £4,600 for sub-station plant.

Leeds.—LOANS.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £3,000 for the extension of electricity supply to Farnley, and £3,500 for a supply to Seacroft.

Maidstone.—ELECTRICITY SCHEME.—The Town Council has decided to submit to the Electricity Commissioners a scheme for supplying electricity to Bearsted at an estimated cost of £6,010, Linton and Coxheath (£5,720), and Barming (£4,730).

Newark.—ELECTRICITY SUPPLY.—In connection with the proposal to obtain a bulk supply from the Derbyshire and Notts. Electric Power Co., it was reported at a recent meeting of the Urban District Council that the company had agreed to the Pelham street depôt as a site for the transforming station, and that the Electricity Commissioners had granted an Order for distribution in the district.

Newhaven. — ELECTRICITY SUPPLY. — The Urban District Council has decided to support the application of Messrs. Crompton & Co., Ltd., for a Special Order to supply electricity within the district.

New Zealand.—LAKE COLERIDGE SCHEME.—The Public Works Department is to erect a duplicate transmission line from Lake Coleridge to Timaru at an estimated cost of £59,000.

HYDRO-ELECTRIC DEVELOPMENT.—In the Public Works statement presented to the House of Representatives, the Minister stated that it would be unwise to spend this year more than £1,133,000 on hydro-electric development. The capital invested by the department in hydro-electric development had increased during the past year to £3,035,000.—*Reuter's Trade Service* (Melbourne).

Northern Ireland.—LURGAN (CO. ARMAGH).—At a recent meeting of the Lurgan Urban District Council the question of completing the town's electric lighting scheme was discussed. A letter was read from Mr. Pleasance, the electrical engineer, stating that it was feasible to complete the scheme at a cost of £10,000. £6,000 has already been spent in laying mains. It was finally agreed to meet the engineer and go into the whole details of the scheme with the object of having it completed.

North-West Midlands.—ELECTRICITY DISTRICT.—The Electricity Commissioners in September, 1920, provisionally determined that certain parts of the counties of Chester, Derby, Salop and Stafford should constitute the North-West Midlands Electricity District. As the result of a local inquiry, they have decided to exclude from the district certain areas in the northern portion, and have published a scheme which they have approved in respect of certain areas in the southern portion to be known as the West-Midlands Electricity District. The northern portion is to be constituted a separate district under the name of the North-West Midlands Electricity District, and representations may be made on account of the inclusion of any district to the Secretary, Electricity Commission, Gwydyr House, Whitehall, London, S.W.1, not later than February 28th, 1925. The Electricity Commissioners intend to hold a local inquiry into the matter, and any body directly concerned with the production or use of electrical energy within the district may, on or before February 28th, 1925, submit a scheme for effecting an improvement in organisation, including if necessary the formation of a Joint Electricity Authority or other body. Notice will be given of the date of the proposed inquiry.

Oldham. — PROPOSED NEW POWER STATION. — The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £566,475 for the erection of a new power station at Chadderton.

Padiham.—NEW POWER STATION.—The Urban District Council has approved of plans for the new station which is being erected by the Lancashire Electric Power Co. at Calderside, and has also adopted a resolution to take a bulk supply from the company.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STRETFORD.—Heating and cooking: The percentage charge has been abolished.

CHELTENHAM.—Lighting: Flat rate, 6d. and 4½d. per kWh; maximum demand rate, 7d. per kWh for the first 125 hours' use per quarter and 3d. per kWh thereafter. Churches: 4½d. per kWh. Kinemas: Combined rate of 3d. per kWh. Power: Other than special contracts, 1½d. per kWh.

PAISLEY.—Lighting: From 6½d. to 6d. per kWh. Heating and cooking: From 1½d. to 1d. per kWh. Power: A reduction of 10 per cent., on ordinary rates and to consumers under contract a reduction of .1d. per kWh.

Salford.—ELECTRICITY AGREEMENT.—The Electricity Committee has recommended to the Town Council that an agreement be entered into with the Manchester Ship Canal Co. for the supply of electricity to the company for a period of ten years.

Slaithwaite (Yorks.).—PROGRESS OF ELECTRICITY SCHEME.—Electricity is available for part of the township through the Council's arrangement with the Yorkshire Electric Power Co. for a bulk supply from the company, and the scheme will be formally inaugurated on December 16th. The Chairman of the Council will subsequently open an exhibition of electric lighting, heating and domestic appliances.

South Shields.—PLANT EXTENSIONS.—The Town Council is to carry out extensions to the plant at the electricity works, and the Unemployment Grants Committee has approved the scheme for the purpose of a grant of 50 per cent. of the interest on the loan raised to meet the expenditure on the scheme not exceeding £62,205.

Stoke-on-Trent.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £9,000 for the laying of a main in East Longton, and is also applying to the Unemployment Grants Committee for a grant towards the cost of the scheme.

Torquay.—ELECTRICITY EXTENSIONS.—It was reported at a recent meeting of the Corporation that the output of the electrical generating station at Newton Abbot continues to increase rapidly, and that application is to be made to the Electricity Commissioners for consent to extend the station. Mr. Woods, the electrical engineer, has been asked to act as consulting engineer in connection with the extension and installation of additional plant. The Stoneycombe Lime and Stone Co. has signified its willingness to take a supply of electricity, and it was recommended that the necessary arrangements be made subject to an agreement being entered into. It was mentioned that the company would take a day load and would consume 250,000 kWh a year, to supply which it would be necessary to lay an extra-high-pressure main from Kingskerswell.

Warrington.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £20,000 for mains and services.

Wimbledon.—LOANS.—The Electricity Committee has recommended to the Borough Council that application be made to the Electricity Commissioners for sanction to the borrowing of £17,250 for additional boiler plant with accessories, and £3,250 for economisers for the two Spearing boilers at the power station, &c.

Worcester.—ELECTRICITY SCHEME.—The Electricity Committee has submitted to the City Council a scheme for the development of electricity supply in the Worcester extended area. According to the *Birmingham Post*, the scheme provides for the construction of 19 miles of overhead e.h.p. transmission lines, 3¼ miles of underground e.h.p. cable, and 20 miles of l.p. overhead distribution lines. It is recommended that the capacity of the transmission lines should be in excess of present requirements, so that a bulk supply could be given to the Shropshire, Worcestershire and Staffordshire Power Co. if necessary. The capital cost of the scheme is estimated at £50,000. The committee has instructed the engineer (Mr. Shaw) to submit the scheme to the Electricity Commissioners for approval.

Wrexham.—LOANS SANCTIONED.—The Town Council has received from the Electricity Commissioners sanction to a loan of £9,285 for plant, &c., in connection with the bulk supply of electricity from the North Wales Power Co. A loan of £1,225 for a sub-station at the Garden Village has also been sanctioned.

Yeadon (Yorks.). — STREET LIGHTING. — The Urban District Council has asked the Electrical Distribution of Yorkshire, Ltd., to submit a scheme and tender for lighting and the maintenance of street lamps in the district. The lighting at present is by gas, and has been the subject of complaint.

York.—LOAN SANCTIONED.—The City Council has received the sanction of the Electricity Commissioners to the borrowing of £27,033 for the provision of additional plant at the electricity works.

Tramway and Railway Notes.

Australia.—MELBOURNE.—The Melbourne *Herald* reports that the Melbourne and Metropolitan Tramways Board proposes to spend £9,000,000 on development in the next 18 years, and about £5,000,000 of this will be absorbed in the conversion scheme.

TASMANIA.—A scheme to connect Hobart with the West Coast mineral fields of Tasmania by means of an electric railway was outlined recently by Mr. A. H. Ashbolt, ex-Agent-General for Tasmania. It is proposed that at the Hobart end the line should start from Glenora, and that the western terminus should be at Rosebery. The railway, when constructed, would be 140 miles in length, and the capital required would be not less than £1,000,000.—*Reuter's Trade Service* (Melbourne).

Belgian Congo.—RAILWAY ELECTRIFICATION.—The Special Commission appointed some time ago to consider the question of the electrification of the railways in the Belgian Congo has now presented a report, in which it is recommended that, having regard to the fact that the work of surveying the water-power resources of the Lower Congo, which has been in hand since 1910, is now completed, the first 56 miles of the Congo railway should be immediately electrified. It is also suggested that a company be formed to establish hydro-electric plant to utilise the water power of the Lower Congo.

Bradford.—RAILLESS CARS.—The Corporation Tramways Department is in communication with the Keighley Corporation tramway authorities with a view to the possibility of linking up the Bradford tramways from the Cross Flats terminus to the Keighley tramways from the Stockbridge terminus by means of a railless-car route.

FARES.—The Corporation proposes to re-introduce penny-fare stages on its tramway system.

Colne.—"ONE-MAN" CARS.—At a recent meeting of the Town Council it was stated that the Ministry of Transport had sanctioned the proposal to run "one-man" cars.

Continental.—BELGIUM.—The electrification of the Antwerp to Wyneghem lines and the section Antwerp to Wommelghem of the Antwerp to Lierre network, which is to be carried out by the Société Nationale des Chemins de Fer Vicinaux, is nearing completion. The transformer station near the Ter Rivieren Park is almost completed, and it is anticipated that the two sections will be ready for working by the end of the year. The total cost of the undertaking, comprising 25 km. of line, is estimated to amount to 6,000,000 fr. At the request of the provincial authorities, the company is making a survey of the Antwerp to Kumpst and Malines and the Malines to Heyst-op-den-Berg lines, for the electrification of which fresh capital will have to be raised.

SWITZERLAND.—Plans are being prepared for the electrification of the Winterthur-St. Gall-Rorschach and Rorschach-Heiden sections of the Swiss Federal railways.

Darlington.—REDUCTION OF FARES.—The Electricity and Light Railways Committee has recommended to the Town Council that the tramway fares be reduced by ½d., with special reductions for workmen's return fares.

Glasgow.—NEW ROUTE.—At a recent meeting of the Town Council the scheme for the construction of a tramway route in George Street was approved.

Grimsby.—PURCHASE OF UNDERTAKING.—The award of the arbitrator in the matter of the Grimsby tramways was received on December 6th by the Town Clerk, and shows that the sum to be paid by the Corporation for the tramway undertaking in the town is to be £109,848.

Guatemala.—NEW ELECTRIC RAILWAY.—*Commerce Reports* states that a contract, signed by the Secretary of Finance and Public Credit and a representative of the Allgémeine Elektricitaets Gesellschaft, of Berlin, and approved by the President, provides for the construction of an electric power plant at Santa Maria in addition to an electric railway line from that city to Quezaltenango. The Republic will issue bonds to the value of $3,000,000 to finance the work.

Halifax.—NEW ROUTE.—The Tramways and Electricity Committee has decided, subject to the approval of the Minister of Transport, to lay a double tramway track connecting Fountain Street and King Cross Lane.

Liverpool.—NEW ROUTES.—The City Council has approved the recommendation of the Tramways Committee that application be made to the Minister of Transport for a Provisional Order for the construction of the following tramways:—Lake Road and Mill Lane, Mill Street, Belve Street, Dingle Mount and Dingle Lane, Marybone, Gardners Row, Bevington Bush and Bevington Hill, Great Crosshall Street, Brownlow Hill, and a junction between Brownlow Hill and Paddington.

Manchester. — FARES. — The Tramways Committee has adopted a proposal of the general manager, Mr. H. Mattinson, extending the first penny stages on all routes from the centre of the city to about a mile and a-half. The general effect of this decision is an extension of about 600 yards on the first penny stage. The Finance Committee states that the reduction is equivalent to a loss of revenue of £150,000 per annum.

Mansfield.—LIGHT RAILWAY EXTENSIONS.—The Mansfield and District Light Railway Co. is applying to the Ministry of Transport for an Order authorising it to extend its tramway system with the object of providing travelling facilities in the colliery districts near Mansfield. The capital cost of the scheme is estimated at £113,000.

The City Railway.—AUTOMATIC SUB-STATIONS.—A further development in the use of automatic sub-stations for traction purposes will shortly take place on the Underground. Contracts have been placed with the Metropolitan-Vickers Electrical Co. for the rotary converters, transformers, and switchgear, &c., for the two sub-stations that will be required for operating the Morden extension of the City Railway referred to elsewhere in this issue. These sub-stations will be at Balham and South Wimbledon and will have installations, respectively, of three 1,500-kW and three 1,200-kW sets. The Balham sub-station will be of the automatic type, on the lines of the one at Burnt Oak on the Edgware extension, and will be controlled from South Wimbledon. Burnt Oak sub-station, with two 1,200-kW B.T.-H. sets, was the first automatic sub-station erected in this country for traction purposes, and during the four months or so that it has been in operation not a single hitch of any sort has occurred.

Telegraph and Telephone Notes.

Australia.—AUTOMATIC TELEPHONY.—The Brisbane (Queensland) central telephone exchange is to be converted to the automatic system. Equipment to cost about £447,670 is to be installed.—*Reuter* (Melbourne).

RADIO "BEAM" STATIONS.—The Amalgamated Wireless (Australia) Co., in which the Commonwealth holds a controlling interest, has accepted the tender submitted by Marconi's Wireless Telegraph Co., Ltd., for the erection of beam wireless stations having an aggregate capacity three times that guaranteed for the high-power station. The British Postmaster-General contracted, on July 28th, with the Marconi Co. to erect a wireless telegraph station on the beam system capable of communicating with Canada and of being extended to South Africa, India, and Australia. The company was to erect reciprocal stations in those countries on behalf of its associated companies.—*The Times.*

India.—PROPOSED RADIO BEAM STATION.—The Government of India is considering an application from an Indian company, directed by a board of prominent Indian business men, for a licence to erect a beam telegraph station forthwith for a commercial service with the United Kingdom. Provided that there were no undue delay in granting the licence, the promoters of the scheme believe that the Indian station would be open to the public in six or eight months. The service would begin with a reduction of 30 per cent. on cable charges. —*The Times.*

The Indian Radio Telegraph Co. is understood to be acquiring the Indian patent rights of the Marconi Co., and also those of American, French, and German companies. Sixty per cent. of the capital will be offered for public subscription. —*Daily Telegraph.*

International Telephony.—CONSULTATIVE COMMITTEE.—The three sub-committees of the International Consultative Committee for long-distance telephone communication which has been sitting in Paris have concluded their labours, and a report of their recommendations is to be prepared for submission to the general meeting of the committee, which will take place in June next. According to the *Morning Post*, a feature of the discussion was the proposal for the adoption of varying tariffs according to the hour at which a call is taken, the reduction proposed ranging from 25 to 50 per cent. of the normal rate. Another proposition concerns the possibility of enabling the public to obtain international calls at fixed hours, either on a regular subscription basis, or by ordering a call in advance for use at a prescribed moment. The possibility of devising means by which a person named may be called to the other end of the line at a determined hour to take a communication, and also the possibility of enabling information of various kinds to be gathered from a distant point by ringing the town in question were also considered. In order to develop long-distance communication as speedily as possible, the sub-committee proposes that certain categories of subscribers, such as newspapers, banks, and large businesses, shall in the near future be invited to make use of free international communication during the slacker hours of the day between London and Rome, *via* Paris; London and Berlin, *via* Amsterdam; London and Stockholm, *via* Hamburg; Vienna and Paris, and Paris and Stockholm, *via* Berlin.

New Zealand.—TELEPHONE AND TELEGRAPH DEVELOPMENT.—In the public works statement presented to the House of Representatives, the Minister stated that it was proposed to spend this year £900,000 on telephone and telegraph extensions and £400,000 on departmental buildings, &c.—*Reuter's Trade Service* (Melbourne).

South Africa.—DIRECT RADIO COMMUNICATION.—Direct radio communication between Poldhu in Cornwall and the South African receiving station at Milnerton, near Cape Town, was established at 12.5 a.m. on December 3rd, Milnerton receiving a message from Sir Edgar Walton (South African High Commissioner in London) to General Hertzog. The experiments reveal greater success as the wave-length is shortened. The tests were started on a 92-metre wave. The experimenters are now working on 60 metres, and it is probable that even shorter lengths will be tried. On December 5th the *Cape Times* received the first Press message direct from England from Senatore Marconi.—*Reuter* (Cape Town).

Turkey.—LONG-DISTANCE TELEPHONY.—There is a plan now under way to provide a telephone service between Angora and Constantinople, says *Commerce Reports.*

Radio Notes.

Broadcasting at Sea.—SHIP'S EXPERIMENTS.—It will not be long before the bigger liners of the United States Shipping Board will be broadcasting at sea or relaying land concerts, all on one wave-length yet to be approved. The *Leviathan's* concert recently was really a preliminary. If listeners tune in after the British stations have closed down on a wave-length of 416 metres, they should get her occasionally. The Board is trying to find a wave-length that will not interfere with other stations, which it will ask the International Wireless Convention to confirm. One British shipping company at least is considering broadcasting from the biggest liners.—*Daily Mail.*

Broadcasting Plays.—BAN REAFFIRMED.—The recent broadcasting of the second act of the musical comedy "Patricia" from His Majesty's Theatre might have been regarded as a sign of an impending change in the situation regarding the broadcasting of plays from the London theatres. The manager, however, is not a member of the Society of West End Theatre Managers, which is still opposed to the idea, and has reaffirmed its ban. The B.B.C. hopes to broadcast plays whenever it gets an opportunity to do so, and the producers of "Patricia" maintain that the improved bookings prove the worth of broadcasting as a means of popularising plays.

Hungary.—MONOPOLY.—The monopoly for the broadcasting service in Hungary has been secured by the Hungarian Telegraph Correspondence Bureau. The first broadcasting station will be set up at Csefrel, near Budapest. The 200-watt telephone transmitting station in the latter city, constructed by the Berlin firm of Dr. E. F. Huth & Co., is used exclusively for Press news. An order for a 2-kW transmitting plant has been given to the Telefunken Co.

Licences.—DEMAND CONTINUES.—An Official of the General Post Office states that at the end of October the number of licence-holders was 993,000, and in the following month the number had increased to over one million.

It is a curious fact that although most of the complaints come from Sheffield, in that city, says the *Evening News*, only an average of 22 people in every 1,000 have licences, the lowest number for any well-populated part of the country. Bournemouth, with an average of 120 licences per 1,000, has the highest percentage, while the average for the whole country is one licence to every 40 people. More licences have been taken out in one month in Leeds than for the whole year in Sheffield.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—BUENOS AIRES.—May 27th. Department of Navigation and Ports. Semi-portal, portal and wall cranes, lifts, capstans and motors.*

Ashford (Kent).—December 24th. Urban District Council. Three 500- to 600-b.h.p. vertical-cylinder heavy-oil engines for the Electricity Department. (See this issue.)

15,000 yards l.p. distributor cable, 12,000 yards e.h.p. feeder and 5,000 yards service cable. (See this issue.)

Australia. — MELBOURNE. — January 13th. Postmaster-General's Department. Telephone indicators and induction coils and registers. January 20th. Condensers. January 21st. Automatic telephone switchboards. (November 28th.)

February 2nd. State Electricity Commission of Victoria. 22,000-V transformers and spares.

April 21st. Commonwealth Postmaster-General's Department. Automatic telephone switchboards and associated apparatus.

February 3rd. Generators, switches, and resistances, reactances and telephone parts, switchboard keys and switchboard jacks.

February 10th. Pedestal and hand sets.

SYDNEY.—February 11th. New South Wales Government Railways. Two lighting storage batteries.

February 4th. Two motor-driven air compressors.

January 27th. Municipal Council. High-pressure oil circuit breakers.—*Reuter's Trade Service* (Melbourne).

Belfast.—December 15th. Electricity Department. Steel framework for internal office building. (November 28th.)

Belgium.—December 17th. Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. Underground electric cable for Salzinnes and Renory. Particulars (Cahier des Charges Special No. 4-135) for 7½ fr.

December 17th. Belgian telegraph and telephone authorities, La Salle Madeleine, Brussels. Supply and laying at Herstal, near Liége, of telephone cable. Particulars (Cahier des Charges Special No. 3-75) for 4 fr.

Birkenhead. — December 14th. Wirral Union. Rearrangement of the well pumping plant, electric power plant, electric lighting, heating, hot-water supply and cooking plant. (December 5th.)

Birstall.—Education Committee. Electric lighting installation at the Council infants' school. Specifications from Mr. B. Sheard, divisional clerk, 8, St. John's North, Wakefield.

British Guiana.—GEORGETOWN.—January 17th. Sewage pumping plant, including electric generating plant, direct coupled to crude-oil engines, complete with switchgear, overhead transmission line, and 50 vertical-type electric motors and pumps. Specifications from Messrs. Howard Humphreys and Sons, 28, Victoria Street, S.W.

Chadderton.—Education Committee. Electric lighting equipment at North Chadderton Senior Elementary Council School. Application to Taylor & Simister, architects, 29, Queen Street, Oldham.

Croydon.—January 5th. Electricity Department. Four 500-kW converting plants, complete with semi-automatic starting equipment. (December 5th.)

Egypt.—CAIRO.—December 22nd. Adjudication and Purchases Board. Two crude-oil engines, two air compressors, and auxiliary machinery for the power station, Tanta main drainage scheme. Specifications from the Adjudication and Purchases Board, P.W.M., or from the Main Drainage Department, P.W.M.

December 28th. Egyptian Ministry of the Interior (Municipalities and Local Commissions Section), Savoy House, Cairo. Supply and installation of the equipment for an electric power station and distribution system for the town of Mellawi.*

Guildford.—January 9th. Board of Guardians. Electric wiring and fittings for the Infirmary Children's Home, &c. (See this issue.)

India. — CALCUTTA. — December 18th. Calcutta Electric Supply Corporation. One electrically-driven centrifugal pump (capacity 2½ million gallons per hour). The Secretary, Central Municipal Office.

December 19th. India Store Department. 9.6 miles 3/.029 4-core telegraph cable for river work in India. (See this issue.)

December 16th. Power plant for Lloyd Barrage Works, Sukkur. Tender forms from the Director-General, India Store Department, Belvedere Road, S.E.

BOMBAY.—February 24th. Bombay, Baroda, and Central India Railway Co. Electrification of Bombay suburban lines: Sub-station and track sectioning switchgear and accessories, rotary converter sets and transformers, alternatively for automatic sub-stations; sub-station equipments and track sectioning switchgear. (See this issue.)

Kent.—County Council. Electric lighting and power installations, Chartham and Barming Heath Mental Institutions. Handcock & Dykes, consulting engineers.

London.—ISLINGTON.—January 16th. Electricity Department. Stores and materials for 12 months, including cables, meters, lamps, transformers, &c. (December 5th.)

METROPOLITAN ASYLUMS BOARD. December 31st. Electric lighting installation at Highwood Hospital for Children, Brentwood. (December 5th.)

CAMBERWELL, S.E.—January 12th. Borough Council. Six or 12 months' supply of electric lamps. Maintenance of electric lighting, heating, and power installations, telephones, &c., for 12 months. Forms of tender from Mr. W. Bell, borough surveyor, Town Hall, Camberwell Green.

Manchester.—December 23rd. Electricity Department. 3-phase, 6,600-V sub-station switchgear, and steel flues for air heater. (November 28th.)

Newton Abbot.—December 16th. Board of Guardians. Installation of electric lighting (118 points) at the institution. Clerk, Union Offices.

Normanton.—December 22nd. Urban District Council. Wiring and fittings for the electric lighting of 100 houses. Particulars from the surveyor, Council Offices.

Portsmouth.—Electricity Department. Two 1,000-kW rotary converters, one 200-kW rotary converter, transformers, and e.h.p. and l.p. switchgear. (November 28th.)

Salford.—December 19th. Board of Guardians. Two "Ideal" boilers, centrifugal pump, electric motor, &c., in connection with the heating of the board room and offices. Mr. E. H. Inchley, clerk to the Guardians, Poor Law Offices, Eccles New Road, Salford.

South Africa.—JOHANNESBURG.—January 3rd. Municipal Council. Transformers.*

January 17th. Traction-testing panel, tramway motors and spares, electric cable.*

Stafford.—December 20th. Town Council. Wiring for electric lighting of 84 houses, Lammascote estate. Specifications and forms of tender from Mr. W. Plant, borough engineer, Borough Hall.

Stoke-on-Trent.—January 14th. Electricity Department. L.p. switchgear. (See this issue.)

Sweden.—STOCKHOLM.—Free Harbour Committee. Portal cranes, capstans, &c.*

Torquay.—Electricity Department. Two 25,000-lb. per hour water-tube boilers with chain grate stokers, elevator, conveyor, bunkers, &c. (November 28th.)

Uruguay.—MONTEVIDEO.—State Electricity Works. December 30th. Four air compressors.*

December 29th. Five distribution switchboards, complete, and one power station generator panel equipment.*

Wigan.—December 18th. Sewage Disposal Committee. Three sets of electrically-driven pumps at the sewage works. Mr. R. B. Donald, borough engineer.

Wimbledon.—January 1st. Electricity Department. One water-tube boiler, superheater, economiser, soot blowers, mechanical stokers, coal elevator and bunker, draught plant, steel chimney and the necessary foundations. (November 28th.)

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*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Electricity Committee.
60-ton electric overhead crane (£2,530).—Marshall, Fleming & Co., Ltd.

Belgium.—La Société des Ateliers de Constructions Electriques de Charleroi, has secured the contract for the electrical equipment of the coal-handling installations which are being established at the railway stations at Rouet and Brussels-Nord, Belgium.

Blackburn.—Town Council. Accepted:—
Installation of a 2,000-kW rotary converter at the Jubilee Street distributing station.—English Electric Co., Ltd.

Electricity Committee. Accepted:—
Coal for the department for the ensuing 12 months.—Dean, Waddington and Co., Blackburn.

Burton-on-Trent.—Corporation. Accepted:—
Cables for Swadlincote (£7,759).—Johnson & Phillips, Ltd.

Doncaster.—Town Council. Accepted:—
Electrically-driven pumping plant at the Nutwell borehole (£1,049).—Worthington-Simpson, Ltd.

Dundee.—Harbour Trustees. Recommended:—
Electrification of new wharf (£3,207).—Johnson & Phillips, Ltd.

Leeds.—Electricity Committee. Accepted:—
Two circulating-water screens for generating station (£950).—F. W. Brackett & Co., Ltd.
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£2,376); Enfield Cable Works, Ltd. (£1,049); The Macintosh Cable Co., Ltd. (£632).

London.—LONDON COUNTY COUNCIL.—Highways Committee. The Committee has had under consideration tenders as follows for the alteration to track feeder cables, &c.:—

Western Electric Co., Ltd.	£34,782
W. T. Henley's Telegraph Works Co., Ltd.	35,892
Siemens Bros. & Co., Ltd.	36,065
Johnson & Phillips, Ltd.	36,250
Enfield Cable Works, Ltd.	36,447
Pirelli-General Cable Works, Ltd.	36,660
Macintosh Cable Co., Ltd.	36,847
W. T. Glover & Co., Ltd.	37,038
British Insulated & Helsby Cables, Ltd.	37,228
Callender's Cable & Construction Co., Ltd.	37,352

The lowest tender is that of the Western Electric Co., Ltd., but it is found that it will be more advantageous to the Council if that part of the work which must be carried out in the factory is executed by contract, and the work required to be done on site is carried out by the Council's own staff. The Western Electric Co., Ltd., has agreed to allow its tender to stand in respect of items which must be carried out in the factory and, thus revised, the tender amounts to £19,529 for work at the factory, with an allowance of £1,522 for the purchase of surplus cable. With provision for extra work amounting to £450, the total net amount of the tender is £18,457. The cost of the work proposed to be carried out by the direct employment of labour is estimated at £7,000, so that the total cost of the proposed alterations, &c., to the feeder cables, including sundry charges, if that part of the work which is done *in situ* be carried out by direct labour, is £25,478, as against £34,782 if all the work is carried out by contractors.

ROYAL MAIL STEAM PACKET CO. Accepted:—
Vacuum and gasfilled electric lamps for six months.—Siemens & English Electric Lamp Co., Ltd.

UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON, LTD. Accepted:—

Rotary converters, transformers, and switchgear for the two sub-stations at Balham and South Wimbledon.—Metropolitan-Vickers Electrical Co., Ltd.

Maidstone.—Town Council. Accepted:—

Fuel oil for the electricity works for a year.—C. C. Wakefield & Co.

Manchester.—Electricity Committee. Accepted:—

Cable.—British Insulated & Helsby Cables, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Callender's Cable and Construction Co., Ltd.

Sub-contractors for one 10-ton electrically-operated crane and gantry:—Motors.—J. P. Hall & Co., Ltd.

Switchgear.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—

Bolt-screwing machine.—Kendall & Gent (1920), Ltd.

Maximum traction trucks.—Hurst, Nelson & Co., Ltd.

Tramcar motors.—General Electric Co., Ltd.; British Thomson-Houston Co., Ltd.

The City Council on Wednesday last week considered the proposal of the Tramway Committee to place a contract for special track work with the United States Steel Products Co. at £1,800, or £85 less than the lowest British tender. It was urged that, considering the Health and Unemployment Insurance payments which the English employer had to pay, and which the American had not to pay, the work ought to be kept at home. Another ground of opposition was that the labour conditions under which the work would be done in the United States were inferior to those operating in this country. One councillor alleged that the employés in the American steel works had to work 12 hours a day, and the firm would not employ a man who belonged to a trade union.

Sir William Barton said he could not conceive that any more dangerous doctrine could be advocated in Lancashire than that contracts should not be placed abroad. Three-quarters of the population of Lancashire were dependent on foreign trade for their living, and if we sent goods abroad we must take goods from abroad. The Council, by 63 votes to 38, decided to refer the matter back for further consideration.

Oldham.—Electricity Committee. Accepted:—

Cable.—Union Cable Co., Ltd.

Rotherham.—Electricity Committee. Recommended:—

Cable (£2,193).—Callender's Cable & Construction Co., Ltd.

Rotary screening plant for feed water (£1,041).—F. W. Brackett & Co., Ltd.

Sheffield.—Electric Supply Committee. Accepted:—

Six 11,000-V, 100-ampere oil-immersed switch-fuse sets (£414).—A. Reyrolle & Co., Ltd.

Construction of transformer sub-stations (£2,098 and £949).—Wellerman Bros., Ltd.

New superheaters for boilers at the Neepsend station (£1,357).—Stirling Boiler Co., Ltd.

Renewal of stokers for boilers (£6,253).—E. Bennis & Co., Ltd.

Stoke-on-Trent.—Corporation. Accepted:—

Coal conveyors and elevators for central power house (£5,184).—Ashton Frost & Co., Ltd.

Steel work for pump house crane gantry (£652).—J. Butler & Co., Ltd.

Torquay.—Electricity Committee. Accepted:—

One 3,000-kW turbo-alternator and condensing plant at the generating station, Newton Abbot (£16 231, plus £55 for installing an enclosed air-cooling system).—British Thomson-Houston Co., Ltd.

Forthcoming Events.

Institution of Production Engineers.—Friday, December 12th. At the Engineers' Club, Coventry Street, W. At 7.30 p.m. Paper on "Heavy Machine Tools," by Mr. C. D. Andrews.

Physical Society of London.—Friday, December 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary Scientific Meeting.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, December 13th. At 62, Wind Street, Swansea. At 6 p.m. Address by the chairman (Sir A. Whitten Brown) on "Electric Winders."

Bradford Engineering Society.—Monday, December 15th. At the Bradford Technical College. At 7.30 p.m. Paper on "Water Purification, with Special Reference to Boiler Feed," by Mr. H. W. Coulson.

Illuminating Engineering Society.—Tuesday, December 16th. At the Lighting Service Bureau, 15, Savoy Street, W.C. At 7 p.m. Further particulars and demonstrations of recent advances in electric lamps and lighting appliances.

Institution of Civil Engineers.—Tuesday, December 16th. At the Institution, Great George Street, S.W. At 6 p.m. Report on the "Measurement of the Pressure of the Wind on Structures," by Mr. T. E. Stanton.

(Students' Section).—Wednesday, December 17th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The Mangahao Hydro-Electric Power Station," by Mr. H. C. Reeves.

Association of Engineering and Shipbuilding Draughtsmen (Birmingham Area).—Wednesday, December 17th. At Queen's College, Birmingham. At 7.30 p.m. Lecture on "The Design of High-speed a.c. Generators," by Mr. W. Sharp.

Radio Society of Great Britain.—Wednesday, December 17th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Annual general meeting. Lecture on "Photo-Electrics," by Mr. C. F. Elwell.

Institution of Mechanical Engineers.—Thursday, December 18th. Annual dinner.

Institution of Electrical Engineers.—Thursday, December 18th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Speeding Up the Telegraphs: A Forecast of the New Telegraphy," by Mr. D. Murray.

(INFORMAL MEETING).—Monday, December 15th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on the New I.E.E. Wiring Regulations, to be opened by Mr. F. C. Raphael.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 15th. At the University, Liverpool. At 7 p.m. Paper on "Automatic and Semi-Automatic Mercury-Vapour Rectifier Sub-Stations," by Mr. G. Rogers.

(North-Eastern Centre).—Wednesday, December 17th. At the Literary and Philosophical Society, Westgate Road, Newcastle-on-Tyne. At 7.30 p.m. Faraday lecture on "World-Wide Radio Telegraphy," by Prof. G. W. Howe.

(North-Western Centre).—Tuesday, December 16th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Automatic and Semi-Automatic Mercury-Vapour Rectifier Sub-Stations," by Mr. G. Rogers.

(Scottish Centre).—Tuesday, December 16th. At the Grosvenor Restaurant, Gordon Street, Glasgow. Annual dinner.

(Sheffield Sub-Centre).—Wednesday, December 17th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "A New Type of Squirrel-cage Induction Motor with High-starting Torque," by Dr. T. F. Wall.

(North-Midland Students' Section).—Tuesday, December 16th. At the Leeds University. At 7 p.m. Paper on "The Mechanical and Magnetic Properties of Steel," by Mr. W. F. Cooper.

Manchester Electro-Harmonic Society.—Friday, December 19th. At the Albion Hotel, Piccadilly, Manchester. At 7 p.m. Concert.

British Electrical Development Association.—SALESMANSHIP CONFERENCE.—Friday, December 19th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Paper on "The Relation Between the Sales Force, the Advertising, and the Public," by Mr. V. W. Dale.

Birmingham Electric Club.—Friday, December 19th. At the Grand Hotel, Colmore Row. At 7 p.m. Annual meeting.

Junior Institution of Engineers.—Friday, December 19th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecture on "Aircraft in Japan," by Col. The Master of Sempill.

(North-Western Section).—Monday, December 15th. At 15, Deansgate, Manchester. At 7 p.m. Lecture on "Fire Fighting, Ancient and Modern," by Mr. G. E. Taylor.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

GREIST portable electric lamps.

Notes.

The Electrical Engineers' Ball, 1925.—The sixteenth annual Electrical Engineers' Ball will be held on Friday, February 13th, 1925, at the Hotel Cecil. Every year this event becomes more popular and more enjoyable—it is one of the great occasions of the winter months in London for electrical men and their fair companions. For the information of those interested we give, as usual, a full list of the members of the general and executive committees:—

GENERAL COMMITTEE.

Addenbrook, G. L.
Alabaster, H.
Andrews, Leonard
Atkinson, Lt. B.
Baldwin, O. H.
Balfour, George, M.P.
Bowden, J. H.
Byng, E. G.
Callender, Sir T. O., J.P.
Chattock, R. A.
Cramb, A. C.
Cridge, A. J.
Cuzens, H. W.
Devonshire, Sir James L., K.B.E.
Elder, T. C.
Fairman, H. W.
Ferranti, Dr. S. Z. de
Fox, E. J.
Gatehouse, E. A.
Geipel, Kenneth
Gill, Frank
Gillespie, M. M.
Gray, James
Gregory, J. P.
Gridley, Sir Arnold, K.B.E.
Hadley, A. E.
Highfield, J. S.
Hirst, Hugo
Hunter, P. V., C.B.E.
Hughman, R. W.
Kemnal, Sir James, K.B.E.
Kerr, Douglas
Kingsbury, J. E.
Knight, C. M.
Leaf, H. M.
Leigh, Lt.-Col. F. A. Cortez
Lonsdale, W. Stanley
McGregor, J. J., C.B.E.
McKinstry, A. E.
McKay, H. T. S.
McMahon, P. V.
Matthews, W. Lee
Mordey, W. M.
Moss, E. W.
Nalder, F. H.
Nash, Sir Phillip, K.C.M.G., C.B.
New, E. S.
Noble, Sir Wm.
O'Brien, Col. H. E., D.S.O.
O'Meara, Col. W. A. J.
Partridge, G. W.
Petersen, T.
Pooley, F.
Purves, Col. T. F.
Pybus, P. J., C.B.E.
Railing, M. J.
Robinson, L. L.
Rogers, F. M.
Rowell, P. F.
Saver, C. E.
Scholey, H., C.B.E.
Shaughnessy, E. H.
Siddeley, H. C.
Sillar, A. M.
Snell, Sir John
Sparks, C. P., C.B.E.
Sutton, Sir George, Bt.
Taite, C. D.
Taylor, Capt. G.
Taylor, James, J.P.
Trezise, J. M. G.
Vyvyan, R. N.
Wallis-Jones, Capt. R. J.
Walton, A. H.
Wilson, David
Woodhouse, W. B.
Wordingham, C. H., C.B.E.

EXECUTIVE COMMITTEE.

O. H. Baldwin
W. S. Lonsdale
A. M. Sillar
R. J. Wallis-Jones
J. E. Kingsbury
P. V. McMahon
C. H. Wordingham, C.B.E.
A. H. Walton

HON. SECRETARIES.

A. M. Sillar W. S. Lonsdale

HON. TREASURER.

J. E. Kingsbury.

Accident. — On December 5th, a Middlesbrough man, Barney Clarke, while working at a local road-making material firm's yard, stepped on to an electric cable. The shock threw him amongst a quantity of scrap metal, and he was taken to the infirmary suffering from several burns and wounds.

Finsbury Technical College Old Students' Association.—The 13th annual dinner of the Old Students' Association was held at the Engineers' Club on Saturday, November 29th, Mr. Arthur J. Chapman, president, in the chair. Among the guests were Prof. Arthur Smithells, Prof. A. J. Hale, Dr. Eccles, Prof. Philpot, Mr. Richard B. Pilcher, and Mr. G. S. W. Marlow.

The toast of "The College" was proposed by Captain Wallis-Jones, who referred to the splendid work of Armstrong, Ayrton, Perry and Thompson, and their colleagues and successors. In the Chair of Chemistry there had followed such well-known men as Raphael Meldola and G. T. Morgan.

Professor A. J. Hale, Dean of the College, in reply, referred to the negotiations which some three years ago, after a threat of closing down, had resulted in a fresh lease of life being given to the College. A new threat to its existence had recently arisen, largely owing, he felt, to a misunderstanding, and he expressed the belief that even yet it would be found possible to keep in being a college which had been the pioneer in technical education.

Professor Arthur Smithells proposed the toast of the "Old Students' Association" in very felicitous terms. He had devoted his life to a work very similar to that of Finsbury; he knew personally most of the great men who had carried on its policy, and from his knowledge of the students there could be no doubt that the great experiment of Finsbury had been extremely successful. He felt that, if the facts were put properly, it was incredible that the authorities should persist in their intention of closing Finsbury.

The President, in reply, said the old students of Finsbury were in an exceptional position to realise the advantages they had gained from association with the College, and during the past year the main work of the Council had lain in taking whatever steps were possible to ensure the fullest consideration of Finsbury's position. He felt sure that their views would not be received unsympathetically by the Board of Education and the London County Council, which now had a very large say with regard to the future of the College.

Fatalities.—An inquest was held at Hartburn, near Stockton-on-Tees, on December 5th, on William Jackson, a foreman, who was found dead on an ash tip near the Bowesfield Steelworks. It was stated that when found the deceased had the cable for a hand lamp clasped in his hands, the lamp portion being in his right hand and the loose end in his left. Walter Collins, the works electrician, said that Jackson had apparently been about to connect the two wires in order to obtain a light. He had evidently forgotten to switch off the current. The Coroner, in returning a verdict of death from electric shock, said he could attach no blame to anyone.

At an inquest on December 5th, on Robert William Dixon, of Shildon, the head electrician at a colliery said that deceased and another man were engaged connecting up aerial wires and he had given them instructions as to which of the 12 wires were "live." The voltage was 2,750. Patrick Clarke, who was working with deceased, said that Dixon disconnected some temporary leads and tied them to the channels. It was necessay that he should get to the other side of the pole. The method he adopted was to climb over the channels, and in doing so he must have slipped. Witness received a shock because the deceased had his foot on the channel on which the witness was standing.

The Deputy Coroner (Mr. E. B. Proud), in returning a verdict of "Accidental death," said that the old adage "Familiarity breeds contempt" seemed to apply to the accident.

While engaged in a switchroom at the Barry Docks, South Wales, on December 2nd, Mr. Sidney Thomas, Barry Island, received an electric shock at 2,000 V and died instantly.

Radio Telephotography.—The transmission of radio telephotographs between London and New York was successfully carried out by the Radio Corporation on November 29th and 30th. All the photographs were recognisable.—*Reuter* (New York).

According to *The Times*, transmission in this country took place from Radio House in London, but the apparatus required for reception has not yet arrived in England. The transmission of a half-plate film by the process occupies about 20 minutes. The method employed is that a photographic film is placed in a revolving drum and an electric transmitting circuit is affected by a beam of light shining through the film on to a photo-electric cell. By this means the ordinary radio telegraph circuit is operated and the illustration is reproduced by a fine pen at the distant station. Transmission was on a basis of a movement of one 128th of an inch for each revolution, but for ordinary reproduction the photograph might be moved one 64th of an inch. Reproduction is apparently obtained by a succession of lines, in which detail is conveyed by varied shades of markings influenced by the degree of light passing through the film to the photo-electric cell.

The invention has been developed by Mr. D. H. Ranger, of the Radio Corporation of America, which acts in association with Marconi's Wireless Telegraph Co., which holds the patent rights for Great Britain and the British Dominions and Colonies. There have already been many experiments in the transmission of photographs by wireless and line telegraphy, but the demonstration was the first of its kind across the Atlantic to be tried publicly. The impulses modulated and amplified passed over 220 miles of land lines and across the Atlantic and were picked up at the end of Long Island by antennæ nine miles long. At the Radio Company's station they were once more amplified and sent over 70 miles of land lines to New York. There a specially constructed fountain-pen actuated by the electric waves reproduced on a paper cylinder in dots and dashes of varying thickness a picture of the negative in London. At the same time photographic apparatus made a new negative.

A Novel Ship's Emergency Set.—An emergency lighting and compressor set of some novelty is being adopted on certain of the 7,500-ton standard motor ships which the Deutsche Werft is building for Norwegian owners. It comprises a single-cylinder 16-b.h.p. A.E.G. hot-bulb engine coupled to a small dynamo and a three-stage air compressor on one bedplate. The compressor works up to a pressure of 1,100 lb. per sq. in., and in case of complete loss of air it will pump sufficient in half an hour to enable one of the 100-b.h.p. two-cylinder auxiliary Diesel engines (driving the ship's generators) to be started.—*Motor Ship.*

Appointments Vacant.—Tramway engineer and manager (£400) for the Luton Corporation. Meter mechanic for the Gellygaer Urban District Council Electricity Department. Engineer and manager (£500 +) for the Inverness Corporation Electricity Department. Two telephone engineers for Buenos Aires for the United River Plate Telephone Co., Ltd. Assistant secretary for the Birmingham Corporation Electricity Supply Department (£400+bonus=£551). (See our advertisement pages to-day.)

Engineer Students from South Africa.—We read in the *Financial Times* that 30 University engineering students from Cape Town, accompanied by seven members of the staff of the Cape Town University, will visit the chief engineering centres of this country early next year. The visit is planned for January, and arrangements for their reception in various centres are now being made. In Sheffield, the University authorities, the Chamber of Commerce, the civic authorities and leading engineering companies are co-operating in the preparation of a programme.

Institution Notes.

Institution of Electrical Engineers.—GYROSCOPES.—At a rather poorly attended meeting on December 4th, Prof. J. G. Gray, D.Sc., and Mr. J. Gray, delivered a lecture on the subject of gyroscopic pendulums. The professor explained that, having been brought up in the Kelvin atmosphere, he had thought it a good thing to show members his collection of spinning tops, which was a large one, including a 3-phase, electrically-driven gyroscope made by Messrs. Elliott Bros. (London), Ltd., that would spin at the rate of 20,000 r.p.m. He pointed out that they had taken the subject up from the experimental aspect, and with the aid of a large amount of apparatus he demonstrated the academic tricks invented by Lord Kelvin. The principles and methods by which he had produced stabilisers and gyroscope "erectors" for aeroplanes were fully described—most ingenious devices—the lecturer remarking that it was all good mechanics, and although experts had used a great deal of mathematics to demonstrate that he was wrong, in practice his contrivances had functioned extremely well.

EXAMINATION RESULTS.—The list of successful candidates in the October A.M.I.E.E. examination contains the names of 27 gentlemen who passed the whole examination; one passed Part I only and nine passed Part II only. Five officers of the Corps of Royal Engineers passed the whole examination. The results relating to candidates who sat for the examination abroad will be published later.

Northampton Polytechnic Institute.—The annual prize distribution which took place on Friday last at the Northampton Polytechnic Institute was the first that has been held since the death of Dr. R. Mullineux Walmsley, who had been associated with the Institute prominently for so many years and whose statements on distribution nights were always so interesting and illuminating. This time was therefore the first occasion on which the new principal, Mr. S. C. Laws, M.A., M.Sc., has had an opportunity of appearing at the annual function. The prizes and certificates were distributed by the Marchioness of Northampton, and the Marquess delivered an address. Following the meeting in the Main Hall there was the usual inspection of the laboratories, workshops, &c., also the programme of general events, including organ recitals, gymnastic displays, &c. On the following night, Saturday, the conversazione of the members and students took place.

Junior Institution of Engineers.—An exhibition of scientific instruments and apparatus arranged by the Junior Institution was held on November 26th. All the instruments exhibited were of special interest, due to the fact that they contained new and original ideas, or that they represented improvements on old principles. Amongst a number of engine indicators was a Farnboro electric indicator for use on engines running at very high speeds. In this indicator the pressure in the engine cylinder is opposed in a valve chamber by compressed air, a reading being recorded electrically when the pressure in the cylinder just balances the pressure of the air and causes a valve to move off one seat on to another. The air pressure

does not vary rapidly, and can therefore be ascertained. The record is made at the moment of equilibrium on a drum which moves in synchronism with the engine piston. A mercury vapour lamp of the atmospheric type with a quartz body was shown in operation. It was said that the use of quartz instead of glass enabled the ultra-violet rays to pass and made the lamp especially suitable for therapeutic and bacteriological work. There was also a portable CO_2 recorder of metal construction with dry absorbents, making it particularly useful and handy for general work.

Institute of Transport.—YORKSHIRE LOCAL SECTION.—At a meeting in Leeds Town Hall of members resident or engaged in the East and West Ridings of Yorkshire and in North Lincolnshire, it was unanimously resolved to form a Yorkshire local section of the Institute of Transport, with headquarters at Leeds. A large attendance included Sir Lynden Macassey, president of the Institute. For its inaugural year the Section has as its chairman Mr. J. B. Hamilton, the general manager of the Leeds Corporation tramway undertaking. Mr. R. Pegler is the hon. secretary and amongst the members of the executive committee are Mr. J. A. Bromley (York tramways), Mr. A. H. Blackburn (Huddersfield tramways), and Mr. E. S. Raynor (Hull City tramways).

Institution of Civil Engineers.—HONORARY MEMBERS.—At the ordinary meeting on December 2nd, 1924, Mr. William Cawthorne Unwin, LL.D., F.R.S., past-president, and Sir Joseph Thomson, O.M., D.Sc., F.R.S., were elected honorary members of the Institution.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

To mark the completion of 21 years in the service of Newcastle-on-Tyne Electric Supply Co., Ltd., Mr. R. P. SLOAN, C.B.E., was the recipient on the 5th instant, of a handsome case of silver, consisting of a tray and salver. The inscription was as follows:—"Presented to Robert Patrick Sloan, Esq., C.B.E., as a token of respect and loyalty by the employés of the Newcastle Electric Supply Co., on his having completed 21 years in the service of the Company—17 years as manager and four years as managing director, 1923-24." The gift was subscribed to by 1,400 members of the staff. Mr. H. A. Couves, in handing over the gift, said that Mr. Sloan could be justly proud of the position he held in the world of industry, being the captain of the largest electricity supply undertaking in the country. During the period of Mr. Sloan's management the volume of the company's business had multiplied itself nearly 60 times. Mr. Sloan expressed his thanks for the gifts, and said that the responsibilities of his position were largely shared by the chief officials of the company, and through them the individual members of the various departments, and but for this help he never could have carried the burden.

MR. F. HOPE-JONES, M.I.E.E., F.R.A.S., has been elected chairman of the British Horological Institute for the current year. Mr. Hope-Jones is well known in connection with electrical timekeeping. It was he who supervised the carrying out of the time-signalling arrangement between Greenwich and 2LO. After breaking the world's records for accuracy of time measurement at the Edinburgh Observatory, the Synchronome free pendulum has now been installed at Greenwich Observatory. This astronomical regulator was the subject of the lecture by Mr. Hope-Jones at the Royal Society of Arts in April last which was awarded a silver medal.

MR. P. J. PYBUS, managing director of the English Electric Co., Ltd., and Liberal candidate for the Shipley Division at the last two General Elections, is to be entertained by the Shipley Division Liberal Association at a social function in the Victoria Hall, Saltaire, on December 16th.

MR. W. Y. SMITH-SAVILLE, chief assistant of Plymouth Corporation tramways, has been selected out of 40 candidates for the post of manager of Exeter Corporation Tramways, in succession to Mr. R. O. Baldwin, resigned.

Swansea Corporation Electricity Committee has re-elected Col. Ald. SINCLAIR chairman and Ald. G. H. COLWILL vice-chairman for the ensuing year.

MR. G. D. KING, recently chief engineering assistant to the Electricity Department of the Worcester Corporation, has taken up an appointment on the engineering staff of the Associated Portland Cement Manufacturers, Ltd.

Modern Transport states that Mr. W. V. MORLAND, engineer and manager of the Nottinghamshire and Derbyshire Tramways Co., the Ilkeston Tramways, and the Midland General Omnibus Co., Ltd., has been appointed general manager of the St. Helens Corporation tramways department.

The Wimbledon Electricity Committee has expressed to the Chief Engineer (Mr. A. E. MCKENZIE), its appreciation of the efficient and able manner in which the generating station and the undertaking generally is being conducted, and has congratulated him upon the successful financial results which he has achieved.

MR. WALTER LAWSON, chairman of the South-Midland Centre of the Institution of Electrical Engineers, whose portrait is reproduced herewith, is a native of Bristol and was educated at the Merchant Venturers' Technical College there. He served an apprenticeship with Messrs. P. Jolin & Co., electrical engineers and scientific instrument makers, afterwards taking up an appointment as lecture assistant to the professor of physics at the University College of Wales, Aberystwyth. He then took charge of the testing department of Messrs. Chamberlain & Hookham, Ltd., Birmingham,

Elliott & Fry [*London.*

Mr. Walter Lawson.

Chairman of the South-Midland Centre of the I.E.E.

for a period of two years. For the past 24 years Mr. Lawson has been connected with the Birmingham Electric Supply Department, and has had charge of the testing and repairing of meters and motors, and the maintenance of all station and sub-station instruments. For four years he has acted as honorary secretary for the management on the Whitley Works Committee of the Department. Mr. Lawson delivered his inaugural address on October 22nd, and it is abstracted in this issue.

The Council of the Society of Engineers has decided to award to Capt. W. J. LIBERTY, the Secretary of the Institute of Public Lighting Engineers, the "Nursey Premium," value £3 3s., for his paper on "Underground London," read before the Society.

Sir PHILIP LLOYD-GREAME has assumed the name of Cunliffe-Lister, and will in future be known as Sir Philip Cunliffe-Lister.

Obituary.—DR. G. MUHLSCHLEGEL.—The death occurred recently in Mannheim, at the early age of 42 years, of Dr. George Muhlschlegel, who had been associated with Brown, Boveri & Co. since 1908 and for some years past had been in charge of that Company's steam turbine testing department.

MR. S. DAY.—The death has occurred suddenly of Mr. Sam Day, who, until recently, was traffic manager at the Hyde Road sheds of the Manchester Tramways. Altogether, Mr. Day had seen over fifty years' service with the Manchester Corporation Tramways and its predecessor, the Manchester Carriage Co.

MR. A. D. CHALMERS.—The death took place in St. Bartholomew's Hospital, Rochester, on November 29th, of Mr. Alexander David Chalmers, who was for some years borough electrical engineer at Gillingham, Kent. He was 49 years of age, and was chief engineer at the electric light works at Gillingham when it was owned by the late Mr. Henry Jasper.

MR. W. M. ROBINSON and MR. W. MARKBY.—We regret to learn that two members of the Metropolitan Electric Supply Co.'s staff, who retired last summer, died on Wednesday and Saturday last week:—Mr. William Mosse Robinson, A.M.I.E.E., who had been employed by the company since 1888, and had been a member of the Institution of Electrical Engineers for 38 years; and Mr. Walter Markby, M.I.E.E., who had been in the employ of the company since 1890 and was a member of the Institution of Electrical Engineers for 33 years.

New Companies Registered.

John Lewis (Wireless), Ltd. (202,073). — Private company. Registered November 29th. Capital, £100 in £1 shares. To carry on the business of wireless engineers, manufacturers of wireless apparatus, including valves, crystals, receivers, &c. The life directors are:—J. Lewis, 6, Buxton Road, Rodwell, Weymouth, electrical engineer (managing director); G. D. Hinks, 36, Middle Street, Yeovil, wireless engineer. Remuneration of J. Lewis, £175 per annum and 2½ per cent. on the actual net sales. Registered office: 6, Buxton Road, Rodwell, Weymouth.

Poynter Griffiths & Co., Ltd. (202,078). — Private company. Registered November 29th. Capital, £6,000 in £1 shares. To carry on the business of manufacturers, exporters and importers of, agents for and dealers in electric and other lamps, bulbs, and all apparatus used for lighting, whether by electricity, gas, oil or other means, and all kinds of radio valves or parts of valves or any type of apparatus used in connection with wireless telephony, &c. The first directors are:—J. F. Poynter, San Remo, Perrymount Road, Haywards Heath, electrical engineer; A. V. Griffiths, 107, Clive Court, Maida Vale, W.9, director of a company; T. H. Griffiths, 95, Rodney Court, W.9, gentleman (all permanent). Qualification of permanent directors, 750 shares; of other directors, 100 shares. Remuneration, £100 each per annum. Secretary: A. V. Griffiths. Solicitors: Trotter, Goodhall & Patteson, 64, Victoria Street, S.W.1.

Lewis Dixon & Son, Ltd. (202,110).—Private company. Registered December 1st. Capital, £1,000 in 500 7 per cent. non-cumulative preference shares of £1 each and 1,000 ordinary shares of 10s. each. To carry on the business of manufacturers, packers and vendors of motor and wireless accessories, general merchants, factors, agents, importers and exporters, engineers, patentees and lessees, &c. The permanent directors are: L. T. Dixon, 4, Heythorp Street, Southfields, S.W.18, electrical engineer; W. T. Bragger, 56, Dundee Road, South Norwood, S.E.25, accountant. Qualification, £10 shares. Registered office: 30, Percy Street, Tottenham Court Road, W.1.

Ledion, Ltd. (202,139).—Private company. Registered December 3rd. Capital, £1,000 in 1s. shares. To acquire trade mark "Ledion" No. 452,008 (Class 8) for wireless accessories. The permanent directors are:—J. H. Douse, 33, Mulgrave Road, S.W.6, manufacturer and merchant; H. Hancocks, 34, Euston Avenue, Watford, manager of instrument wire company; Mrs. L. E. Douse, 33, Mulgrave Road, S.W.6; C. F. Richards, 12, Chandos Road, Tottenham, N. (sales manager, Re-Echo Radio Co., Ltd.). Secretary: Mrs. L. E. Douse. Registered office: 43, Johnson Street, Westminster, S.W.

Wireless Novelties, Ltd. (202,148).—Private company. Registered December 3rd. Capital, £500 in £1 shares. To adopt an agreement with H. Soper, and to carry on the business indicated by the title. The permanent directors are:—H. Soper, 166, Burbage Road, Herne Hill, S.E.; Mrs. Clara May, 166, Burbage Road, Herne Hill, S.E. Registered office: 27, Elm Park, Brixton Hill, S.W.

Wilkins Electrical Works, Ltd. (202,174).—Private company. Registered December 4th. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer carried on by F. L. Wilkins as "Wilkins Electrical Works," at 1, Keith Grove, Shepherd's Bush. The first directors are:—P. L. Wilkins, 63, Bassett Road, W.10; L. Fraser, 30, Highlands Avenue, W.3. Manager: L. Fraser. Solicitors: Edmund Beal and Davey, Stone Buildings, Lincoln's Inn, W.C.2. Registered office: 1, Keith Grove, Shepherd's Bush, W.12.

National Electrical and Engineering Co. (2,384 F.).—Particulars of the National Electrical and Engineering Co., Ltd., were filed on November 26th, pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in New Zealand. The British address is Trig Lane, 23, Upper Thames Street, E.C.4, where N. Jones is authorised to accept service of process and notices on behalf of the company. The directors are:—G. Mondy and J. V. Stephens, both of Dunedin, and E. W. Ackland, of Wellington, New Zealand. No memorandum or articles of association have yet been filed.

S. M. F. Electrical Supplies, Ltd. (202,054).—Private company. Registered November 29th. Capital, £100 in £1 shares. To carry on the business of manufacturers of, and dealers in electrical fittings, wireless parts, loud speakers, telephones, valves, accumulators, batteries, glassware and kindred articles, &c. The first directors are:—E. J. Mitton, 13, Oozells Street North, Birmingham; R. F. Fuller, 130, Oxford Road, Moseley, Birmingham (director of Hurst & Mitton, Ltd.). Qualification, 1 share. Registered office: 21, Cumberland Street, Birmingham.

Enclosed Motor (Foreign Patents) Co., Ltd. (202,017).—Private company. Registered November 28th. Capital, £1,250 in £1 shares, two of such shares shall be "A" and "B" respectively. The "A" share is entitled to 12 per cent. of the profits divided as dividend, and on any sale of the company's business or undertaking, or any part thereof, to 12 per cent. of the consideration of such sale; and the "B" share is entitled to 4 per cent. of such profits and to 4 per cent. of the consideration for the sale of any of the company's business or undertaking, or any part thereof. To adopt an agreement with P. A. H. Mossay and H. C. E. Jacoby, and to acquire and turn to account any patents, licences, concessions, &c., relating to the application, distribution, and use of electricity and of any apparatus therefor. The first directors are:—P. A. H. Mossay, address not stated; Sir Alfred S. Mays-Smith, Bank Buildings, 16, St. James's Street, S.W.1, engineer; S. Smith, 38, Old Park Road, Palmer's Green, N.13, electrical engineer. Remuneration, £75 each per annum. Solicitors: C. E. W. Ogilvie & Co., 32, Essex Street, Strand, W.C.2.

Mur-Ray Signs, Ltd. (203,092).—Private company. Registered December 1st. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, and dealers in reflector signs and other signs and advertisements, &c. The first directors are:—R. H. Murray, 29, Princess Street, Manchester; L. A. Yeomans, 29, Princess Street, Manchester. Qualification, £1. Registered office: 29, Princess Street, Manchester.

Metropolitan-Vickers Electrical Co. (Mediterranean), Ltd. (202,091).—Registered as a private company on December 1st with a nominal capital of £1,000 in £1 shares. The objects are: To buy, sell, deal in, export, install, and repair, work and maintain all kinds of electrical and mechanical plant and machinery, lamps, wires, fittings and apparatus, bearings for motor-cars, and appliances for the application of power of all kinds, &c. The signatories to the memorandum of association (each signing for 1 share) are:—R. H. Haviland, 4, Central Buildings, Westminster, S.W., company secretary; and C. S. Thomson, of the same address, engineer. The first directors (to number not less than three nor more than six) are to be appointed by the signatories. Remuneration as fixed by the company. Solicitors: E. F. Turner & Sons, 115, Leadenhall Street, E.C. Secretary: R. H. Haviland. The registered office is at Trafford Park, Manchester.

The Telephone Development Association (202,230).—Registered on December 5th as a company limited by guarantee and not having a capital divided into shares, the word "limited" being omitted from title by licence of the Board of Trade. The objects are: To promote and encourage the use of the telephone in Great Britain and other parts of the British Empire and elsewhere. The management is vested in a council, the first members of which are:—L. B. Atkinson, "Alster," Great Missenden, Bucks.; F. Gill, 58, Scots Lane, Shortlands, Kent; F. Hird, Lanark House, Old Charlton, S.E.7; H. Hirst, 40, Park Lane, W.; R. Lawton, "Boothorpe," Woodville, Burton-on-Trent; W. L. Matthews, 32, Gordon Square, W.C.1; H. M. Pease, 88, Kensington Court, W.8; Sir Alexander Roger, Yockley House, near Camberley; and Sir George Sutton, Home Lodge, Beckenham. Solicitor: T. Trimnell, 1, Lincoln's Inn Fields, W.C.2. The registered office is at Aldine House, 10, Bedford Street, Strand, W.C.2.

Official Returns of Electrical Companies.

Leatherhead and District Electricity Co., Ltd.—Issue on November 10th, 1924, of £12,850 debentures, part of a series already registered.

M.E.L., Ltd.—Debenture dated November 10th, 1924, to secure £4,100, and further advances not exceeding in all £5,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Rogers, Court Lodge, Horton Kirby, Kent.

C. P. Martin & Co., Ltd.—Debenture dated November 15th, 1924, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: H. A. Wernter, Somerics House, Regent's Park, N.W.1.

Connaught Engineering Co., Ltd.—Debenture dated November 18th, 1924, to secure £1,500, charged on the company's property, present and future, including uncalled capital. Holder: M. Gainsborough, 8, Connaught Street, W.

Marconi International Marine Communication Co., Ltd. (65,759).—Return dated August 13th, 1924. Capital, £1,500,000 in £1 shares. 1,192,726 shares taken up. £1,087,726 paid. £105,000 considered as paid. Mortgages and charges, £57,300.

South London Electric Supply Corporation, Ltd. (50,392).—Return dated April 10th (filed July 7th), 1924. Capital, £310,000 in 50,000 preference and 260,000 ordinary shares of £1 each. 30,000 preference and 260,000 ordinary shares taken up. £290,000 paid. Mortgages and charges, £130,000.

Midland Electric Wire Co., Ltd. (104,571).—Return dated April 14th, 1924. Capital, £5,000 in £1 shares. All shares taken up. £5,000 paid. Mortgages and charges, nil.

Wadebridge and District Electric Supply Co., Ltd. (138,776).—Return dated April 28th, 1924. Capital, £3,450 in 1,250 preference and 2,200 ordinary shares of £1 each. All shares taken up. £400 paid. £2,900 considered as paid. Mortgages and charges, £850.

Contraflo Engineering Co., Ltd. (110,264).—Return dated May 9th, 1924. Capital, £80,000 in £1 shares. All shares taken up. 7s. per share called up on 27,000 shares. £9,450 paid. £53,000 considered as paid on 53,000 shares. Mortgages and charges, nil.

London Electric Wire Company & Smiths, Ltd. (101,353).—Return dated April 23rd, 1924. Capital, £1,250,000 in 750,000 ordinary and 500,000 preference shares of £1 each. 644,070 ordinary and 400,000 preference shares taken up. £350,035 paid on 35 ordinary and 350,000 preference shares. £694,035 considered as paid on 644,035 ordinary and 50,000 preference shares. Mortgages and charges, nil.

Ellerd-Styles & Co., Ltd.—B. R. Morris, and S. Young, of 287, Upper Street, Islington, N.1, ceased to act as receivers or managers on behalf of the debenture holders on November 20th, 1924.

Spencers (Electrical), Ltd.—Particulars filed of £500 debentures authorised November 18th, 1924, charged on the company's undertaking and property, present and future including uncalled capital, the whole amount being now issued.

General Electric Tramways Co., Ltd. (43,428).—Return dated April 10th (filed July 21st), 1924. Capital, £50,000 in £1 shares. 18,500 shares taken up. £18,500 paid. Mortgages and charges, £11,000.

Durham and District Electric Traction Co., Ltd. (79,285).—Return dated July 14th, 1924. Capital, £30,000 in £1 shares. Seven shares taken up. £7 paid. Mortgages and charges, nil.

S. Bornett & Co., Ltd. (89,565).—Return dated October 14th, 1924. Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. 807 preference and 950 ordinary shares taken up. £1,007 paid. £750 considered as paid. Mortgages and charges, nil.

Alert Electrical Co., Ltd. (78,971).—Return dated February 28th (filed July 4th), 1924. Capital, £2,000 in £1 shares. 708 shares taken up. £708 paid. Mortgages and charges, nil.

Henley's (South Africa) Telegraph Works Co., Ltd. (77,781).—Return dated March 7th, 1924. Capital, £2,000 in £1 shares. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Geo. Bray & Co., Ltd. (76,185).—Return dated May 28th, 1924. Capital, £100,000 in 80,000 preference and 80,000 ordinary shares of £1 each. 55,000 preference and 55,000 ordinary shares taken up. £7 paid. £109,993 considered as paid. Mortgages and charges, £40,000.

City Notes.

Southern Brazil Electric Co., Ltd.

The annual meeting of this company was held on December 3rd. Mr. E. H. Tootal (chairman), in moving the adoption of the report and accounts, said that the year had been a disappointing one, the sterling loss amounting to £18,990, as compared with £12,927 in the preceding year. This increased loss, however, was more apparent than real. In point of fact the revenue in Brazilian currency showed a steady improvement, but the services had to be maintained and extended, and the burden of this fell upon the revenue in the absence of other funds. The company had also commenced the payment of arrears of income tax; these now showed a considerable reduction. During the revolutionary outbreak in July last the company carried on its services as well as possible in the difficult circumstances, and, fortunately, none of its property was damaged. A severe drought had also been experienced, but the company continued to obtain enough water for its requirements. Following the recommendations of the Financial Commission, the Government was making efforts to cut down expenditure, and as a result the exchange was improving when the revolution broke out, causing a relapse. There were, however, encouraging features at present in evidence. Brazil was in a prosperous condition, and the Federal revenues were showing a substantial increase. This should eventually prove of advantage to the company.

Edison Swan Electric Co., Ltd. The report for the year ended June 30th, 1924, states that the trading results for the period were satisfactory, and the accounts show that after making provision to the extent of £7,441 for the redemption of debenture stock, the profit for the year amounts to £74,914, plus £19,304 brought forward, making £94,219. This the directors recommend should be applied as follows:—7½ per cent. dividend on preference shares £7,500, 10 per cent. dividend on ordinary shares £19,143, transfer to reserve fund £50,000, leaving a balance to be carried forward (subject to Corporation Profits Tax) of £17,575. Mr. J. Wilfrid Drake has been appointed a director. Annual meeting: December 17th.

Prospectus. *Agar, Cross & Co., Ltd.*—The list was to close on Wednesday in an issue of £500,000 5½ per cent. mortgage debenture stock at 90 per cent., but before mid-day on Monday the required amount had been subscribed nine times over. The business, which has been established since 1884, is that of export merchants to the River Plate of agricultural, industrial, and electrical machinery, &c. The company has branch houses in Buenos Aires, Rosario, Bahia Blanca, Tucuman, and Mendoza, and also in New York. Owing to the continued expansion of the business and the increased amount of capital that is now necessary to carry stock-in-trade, more capital has to be raised in the interests of the business. That is the purpose of the present issue, it being intended to redeem the balance of the original debentures which are now outstanding, and to provide additional working capital from the balance. The prospectus contains full particulars regarding the profits earned during the past six years.

Companies Struck off the Register.—The undermentioned companies have been struck off the Register, and are thereby dissolved:—

Kelvin-Hardy Electric Co., Ltd.
Quain Electric Co., Ltd.
Radiola Wireless Telephone Parts Co., Ltd.
Thurlow Wholesale Electric Supplies, Ltd.
Yorkshire Battery & Manufacturing Co., Ltd.

Power-Gas Corporation, Ltd.—The report for 1923-24 states that although adverse trade conditions continued, the company obtained an increased volume of orders, particularly towards the end of the year. The profit for the year was £23,268 (including £11,070 brought in and £12,198 from taxation reserve). The reserve fund receives £2,000, and the balance is carried forward.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted:—
Victoria Falls and Transvaal Power Co.—1,000,000 ordinary shares of £1 each, fully paid, Nos. 1 to 1,000,000.

Canadian General Electric Co., Ltd. — A dividend of 1¾ per cent. has been declared on the preference stock for the last quarter of the current year.

Electric Supply Co. of Victoria, Ltd.—A dividend of 10 per cent. has been recommended on the ordinary shares out of profits of £36,966, plus £60,204 brought in. A balance of £60,114 is to be carried forward. This is the first ordinary dividend declared since the formation of the company in 1900.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The dividend on the 6 per cent. preference shares, for the half-year ending December 31st, has been declared.

Phillips Incandescent Lamp Co.—An Amsterdam dispatch to the *Financial Times* states that this company has just issued 1,113,000 guilders of 6 per cent. cumulative preferred participating shares and 3,500,000 guilders common shares, for the purpose of providing means for financing the constant development of foreign affiliated companies, and new participations in the radio field.

Manx Electric Railway Co., Ltd.—Out of profits of £18,123, plus £1,138 brought forward, it is proposed to pay a dividend of 5½ per cent. on the preference shares in respect of 1919-20. £930 is to be carried forward.

North Metropolitan Electric Power Supply Co.—An interim dividend of 3 per cent. on the ordinary shares is announced.

W. & T. Avery, Ltd.—Interim dividend of 5 per cent., less tax, on ordinary shares.

Great Northern Telegraph Co., Ltd., of Denmark.—An interim dividend of 5 per cent., less tax, has been declared.

Premier Accumulator Co. (1921), Ltd.—An interim dividend of 5 per cent., less tax, has been paid.

Stocks and Shares.

MONDAY EVENING.

THERE is nothing like such a rush now, in Stock Exchange markets, as the House was called upon to deal with during November. Prices maintain their levels with an all-round firmness which is the more significant in view of the approach of the end of the year, a time when, as a rule, some people are selling stock, and others are holding back money in order to accumulate a good bank balance at the end of December. The stream of new issues goes on steadily week by week, many of the loans being of substantial proportions. In spite of these calls for capital, however, the existing stocks and shares yield little ground, from which it is apparent that money in plenty is available, a state of affairs that prevails not only in London, but in the New York and other United States stock exchanges. The difficulty is to get stock with which to satisfy the requirements of the prospective buyers, although this may seem anomalous, having regard to the huge outpouring of new issues that has taken place even within the past month.

Amongst electricity supply shares, County of Londons stand out with a further rise of 1s. 9d., which has carried the price to 52s. 6d., at which the yield on the money is a little less than 5¼ per cent. City of London remain at 47s. 6d. Charing Cross ordinary are better at 45s. 7½d.; Notting Hill preference at 9¾ are 5s. up. St. James's rose to 12¾. Newcastle-on-Tyne shares are stronger, the ordinary being nearly 23s., and not easy to buy at that price. Folkestones have improved to 35s. The other provincial and suburban supply companies' shares continue to receive a good deal of attention without this producing any particular effect upon prices for the moment. Victoria Falls ordinary are a firm market at two guineas. Midland Counties new 6 per cent. preference change hands freely on the basis of 21s. 3d. Clyde Valley new ordinary are being dealt in at 4s. 3d. premium.

Anglo-Argentine Tramways have started to recover after the sharp fall produced by the news that the Municipal Council of Buenos Aires had declined to renew the company's concession. According to private advices received during the past day or two, this decision was reached by the Municipal Council on a snap division engineered by the Socialistic Party, and it is said that the decision went against the company by the vote of a single member. Confirmation of this is lacking at the time we write, but the strengthening of Anglo-Argentine Tramway first preference, to 3 1/16, deserves to be noted.

Mexicans are weak, the Tramways Company's 5 per cent. Bonds falling back to 74, while Mexican Light and Power preferred at 59½ are a point lower, and have changed hands down to 56½ within the past week. British Columbia stocks continue to harden, the preferred at 89¼ being 1 up. Brazilian Tractions drooped to 57. British Electric Traction ordinary and preferred are both ex dividend, and, allowing for the deductions, there is a small improvement on balance. The London traction issues are dull, London & Suburban preference falling back to 7s. middle. The company's dividend announcement is due in the early spring, and, if the present price is anything to go by, the declaration is awaited without enthusiasm. The company's ordinary shares were done at three-halfpence last week. British Automobile 8 per cent. preference at 23s. 9d. show a modest gain. The company's 5½ per cent. debenture stock is quoted at 92 middle.

While Marconis and the Wireless shares as a whole keep steady, cable stocks are disposed to droop. Eastern ordinary fell back to 170, though Westerns at 17¼ are again better, reflecting the favourable sentiment produced by the excellent report recently published. Globes are ex dividend in the cases of both ordinary and preference. Chili Telephones have gone back to 5¾. Anglo-American Telegraph deferred strengthened to 24¾ and United River Plate Telephones are 1/16 better at 6 15/16. Due heed has been paid to a remark that the Telegraph Construction Company may increase its dividend, and a further rise of 10s., to 26¼, shows that the hint has not been lost on the investor who is willing to handle such comparatively high-priced shares. Venezuela Telephones strengthened to 19s. 4½d. on the increased dividend. Radios are 9¼ and 10 for the common and preferred respectively.

The Edison Swan Co. did well in the year lately ended, and an increase in the dividend, from 7½ per cent. to 10 per cent., explains the reason for the advance in the price which has occurred during the past month. The company's 5 per cent. debenture stock is 7 points up at 83½. The policy of reorganisation of capital has justified itself to shareholders, and the present price of the shares is not excessive. Siemens fell back to 22s. 6d., a few profit-takers continuing to press shares on the market. Johnson & Phillips new shares stand at 3s. premium for renunciation letters. Wednesday in this week was the last day fixed for shareholders to claim these important rights. Brush shares are steady at 23s. 9d.

The Home railway market is better all round. Definite announcement that the Exhibition will be open next year led to sharp rises in Central London ordinary, Metropolitans, Districts, Underground ordinary and "A" shares. There was not much stock available to supply the needs of those who came in buyers on the assumption that the 1925 Exhibition will prove a material aid to the company's traffics. The re-opening of the City and South London Railway restores a very useful feeder to the other Tube lines.

Babcock & Wilcox gave way a trifle to 48s. 9d., the engineering section, together with that for iron, coal and steel shares, being slightly disposed to dulness. Armament shares have kept up well, Vickers being maintained at 12s. 6d. The rubber share market is surprisingly apathetic in view of the rise to 1s. 6¼d. in the price of the raw material, which, taken in conjunction with further reduction in the visible stocks on hand, might be supposed to quicken the imagination of those who support the rubber share market. But perhaps they are too intent upon their tea share speculations to pay any particular heed to rubber for the time being.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Dec. 8, 1924.	Rise or fall.	Yield, p.c.
Brompton Ordinary	1	12	10	12½	—	*£5 6 8
Charing Cross Ordinary	1	14	14½	2⅝	+ ⅛	6 7 2
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	47/6	—	6 6 4
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	52⅛	+1/9	5 14 1
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
Edmundson's Ordinary	1	7	7	22/-	—	... ...
do. 7 % Pref.	1	6	6	21/6	—	6 4 5
Kensington Ordinary	5	13	14	94	—	7 5 5
London Electric	1	10	10	22/6	—	6 3 1
do. do. 6 % Pref. ...	5	6	6	5⅞	—	5 10 4
Metropolitan	1	8½	10	13	—	5 6 8
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	9½	6	92/6	+6d.	5 9 1
do. 5 % Pref. ...	1	5	5	17/6	—	5 14 8
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	92	+ ½	6 4 5
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	19/9	—	4 4 6
do 6 % Pref. ...	1	6	6	19/6	—	6 3 1
St. James' and Pall Mall ...	5	14½	17½	125	+ ½	6 16 0
South London	1	11	15	21	—	6 13 4
South Metropolitan Pref. ...	—	7	7	12	—	5 12 0
Westminster Ordinary	5	13	15	11	—	6 16 4
Whitehall Elec. Invest. 7½ % Pref.	1	7½	7½	19/-	—	7 18 0

HOME RAILS.

Central London Ord. Assented Stock	4	4	72	+1½	5 12 0
Metropolitan ... ... ,,	8½	4	80½	+2	4 19 5
do. District ... ... ,,	8	8½	55½	+2	6 8 2
Underground Electric Ordinary	10	Nil	Nil	3	+ ¼	Nil
do. do. "A" ...	1	Nil	Nil	9/8	+ 1/-	Nil
do. do. Income Bonds	5	6	99	—	*5 1 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24½	+ ¼	6 3 1
Chili Telephone	5	6	6	5⅞	— ⅛	*5 4 4
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	17	—	*5 17 8
Eastern Tel. Ord.	Stock	10	10	170	— ½	*5 17 8
Globe Tel. and T. Ord.	10	10	10	17½xd	—	*5 16 0
do. do. Pref.	10	6	6	11½xd	—	5 7 10
Great Northern Tel.	10	24	22	30	— ½	7 6 8
Indo-European	25	7	7	22½	—	*5 6 1
Marconi	1	15	10	22/6	—	6 13 0
Oriental Telephone Ord.... ...	1	12	12	1½	—	*8 8 0
United R. Plate Tel.	5	8	8	6⅛	+ ⅛	*5 15 5
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	17½	+ ½	5 16 8

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref....	5	12½	5⅝	5⅞	+ ⅛	8 19 6
do. do. 2nd Pref. ...	5	5⅛	6	2⅛	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	79½	—	6 16 0
British Electric Traction Ord....	,,	6	6	99½xd	+2	6 0 6
do. do. 6% Pref. ...	,,	6	6	103½xd	+1	5 16 0
Brazil Traction	100	4	4	57	— ½	7 0 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	85½	—	5 13 0
do. do. Preferred	,,	5	9d/-	89½	+1	*5 7 6
do. do. Deferred	,,	5	19s/6	111½	—	*5 16 0
do. do. Deb.	,,	4½	4½	80½	—1	5 5 7
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	2/-	—6d.	7 2 10
London United Tram. Deb. ...	Stock	4	4	56½	—	7 1 7
Mexico Trams. 5% Bonds ...	—	Nil	5	7½	—1	6 13 4
do 6% Bonds ...	—	Nil	Nil	56	—	Nil
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	50½	—1	Nil
do. 1st Bonds ...	—	5	5	86	—	7 11 6

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	3⅞	—6d.	♦4 18 6
British Aluminium Ord.... ...	1	5	5	28/9	—	5 1 8
British Insulated Ord.	1	15	15	66/3	—	5 9
Callenders	1	15	15	2½	—	5 6 9
do. 6½ Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅞	—	5 17 10
Edison-Swan	£/-	7½	10	6/9	—	4 8 9
,, 5% Deb.	Stock	5	5	80½	+7	5 19 9
Electric Construction	1	10	10	30/-xd	—	6 13 4
English Electric	1	8	8	19/3	—	8 4 0
do. do. Pref. ...	1	6	6	1	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	5	5	21/-	—	4 15 3
Henley	1	15	15	2½	—	5 6 9
do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	8	17/6xd	—	*5 14 8
Met.-Vickers Pref....	2	8	8	9½	—	6 8 0
Siemens Ord.	1	5	—	1½	— ⅛	4 9 0
Telegraph Construction	12	20	20	20½	+ ½	*4 10 6

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price Dec. 9.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£35	...
a Copper Sulphate ... ... ,,	£35 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£237	£3 dec.
Grade II ... ... ,, ,,	£171	£1 dec.
Grade III ... ... ,, ,,	£9)	£2 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	10½d.	½d. inc.
c ,, Tubes (solid drawn) ... ,,	1/- to 1/0½	...
c ,, Wire, basis ... ... ,,	10½d.	½d. inc.
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£95	£1 inc.
c ,, Sheet ... ... ,,	£95	£ inc.
c ,, Rod ... ... ,,	£95	£1 inc.
d ,, (Electrolytic) Bars ... ,,	£68 10s.	10/- inc.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ... ,,	£78 10s.	10/- inc.
d ,, ,, H.C. Wire per lb.	9 3d.	½d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f Sheet ... ... ,,	2/- to 3/6	...
a German Silver Wire ... ... ,,	2/8	...
h Gutta-percha, fine ... ... ,,	9/-	...
h India-rubber, Para fine ... ... ,,	1/6½	½d. inc.
f Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
f ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£40 15s.	10/ dec.
g Mercury ... ... per bot.	£11 to £11 5s.	7 6 inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/8½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/9½	...
p ,, ,, wire ... ... ,,	1/4	½d. inc.
e Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/6½	...
r Steel, Magnet, in bars ... ... ,,	8d.	...
n Tin, Block (English) ... ... per ton.	£257 10s. to £257 15s.	10/- to 25/- inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	8/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Corrosion-proofing Armoured Cables. — The desirability of having one or more impervious layers of compound over the lead and armouring of underground and mining cables, especially where they are used under corrosive conditions, has long been recognised. It has, however, hitherto been difficult to effect this owing to the fact that the layer of compound both under and over the armouring has necessarily to be applied hot and, therefore, in a plastic condition and when the jute or armouring is bedded upon it, it exudes. Moreover, when it reaches the drum, or even when it is *in situ*, it is liable to decentralise at the working temperature of the cable. To overcome these difficulties the British Insulated & Helsby Cables, Ltd., has provisionally protected a manufacturing process which, whilst permitting of a greatly increased thickness of this compound layer, and a consequent improvement in the waterproof qualities of the cables, prevents any decentralisation taking place under heat. The process may briefly be described as follows: The lead, bitumen or rubber sheath is protected in the usual manner by a thin layer of compound, and a layer of treated tape. One or more wires are then wound over the tape in the form of a cylindric spiral as in a spring. The convolutions of the spiral are filled in with a waterproofing plastic compound, and the cable is taped and armoured in the usual manner. The centralisation of the cable under all conditions is ensured by the fact that the spiral wound wire forms a spacing medium between the armouring and the cable sheath, which hitherto had been separated by a viscous layer of tape and compound. A layer of compound of any thickness can thus be applied, dependent only on the diameter of the spacing wire used. The invention will prove of particular value when the cable is likely to be installed in a position where corrosion is likely to occur, and the company is to be congratulated upon a further advance in British cable making.

Increased Production—Decreased Unemployment.

(*Concluded from page* 871.)

Defective Materials and Work.

In a costing system it is very important to provide for the scrutiny of so-called defective charges rather than, as is common with some factories, to have these costs absorbed in the ordinary cost of a product without any means of examining separately the increased cost of labour and material due to defective work within the factory and on account of defective material received from outside suppliers. Under the heading of defective labour or material should be included the cost of extra work which has to be done on account of, for instance, excessive machining allowances being put on castings, distortion and blow holes in castings, hard spots, &c., and this class of extra cost should be allocated as an expense due to defects in material. Often material is purchased in the cheapest market, but the amount saved by buying in this market is more than lost by the extra cost of production in the works, and unless arrangements are made in the costing system to bring this to light, steps cannot be taken to correct this increased cost of production for future orders. Other extra costs, due to defective work on the part of workpeople should also be allocated separately so that the skill of the workpeople and inaccuracies in machines are disclosed. Whether these defective charges are absorbed in the overhead expenses or as a particular charge against the job, does not matter so long as they are kept separate, and opportunity is given to the individuals or departments most concerned to scrutinise the charges and to see what steps can be taken to bring them down to a minimum.

Planning.

It will be recognised that a big factor in an efficient costing system is making provision for the discovery of leakages in the cost of manufacture, but in many systems these are not discovered until the money has been spent. We therefore suggest that it is even more important to organise means for preventing such leakages, and we would point out that this can be accomplished by proper organisation of planning. Properly constituted, with the right sort of experts dealing with it, steps can be taken to ensure that no money is spent in the shops over and above that provided for in the estimate without its being referred to the planning department. Incidentally, this department can also be used for estimating. As the principles underlying a department of this kind are not generally understood, we will briefly outline their application in a modern engineering works. Drawings are sent from the drawing office to this department, which prepares piecework prices and methods of operation, and specifies the type of machine on which the work is to be done; it should also prepare the time sheet as soon as the drawings are received and long before the work goes into the shop. These records go through the various departments and are issued to the men through the foremen. Any departure from these records can only be made in conjunction with this planning section. This is an enormous advance on the old-fashioned methods where much of this work was left to the foreman of the department, with no proper check as to whether the right method was being followed or the right time allowed for the particular operations, and, as stated before, the costing would probably never disclose whether any particular operation had cost more than it should, or whether the operation had been done in the right way or not. The planning department, which should include the tool department, takes care of this. The managements of factories which are not familiar with an arrangement of this description need not be sceptical. If properly organised, it is not costly to introduce and maintain, but is of enormous value.

In connection with processing, a word with regard to piecework would probably not be out of place. In the average factory, piecework is a sound proposition, although it may be of interest to those who are not familiar with the Ford factory to know that the workmen are paid per hour much more than they are paid in this country, but there is no piecework. The equivalent is obtained by ensuring that at least a certain output is obtained per man. In multiple factories this system cannot be applied, and therefore it is necessary to introduce some kind of system of payment by results. Having made an estimate for a definite piece of work and fixed a piecework price on that basis, one should allow a man to make the maximum he can, irrespective of what percentage it is of the basis price, and on no account should the price be cut unless absolutely necessary, and even then an arbitrary cut should not be made; the men should be consulted through the works committee, it being pointed out to them that this has been necessary in order to obtain the contract, and that if this procedure had not been taken, the possibility of regular employment would be diminished. If this advice is followed, the present suspicion that still exists in many works that the employer will cut the price if the man earns more than a certain percentage will gradually and surely disappear. It is necessary, of course, for the management to satisfy itself that the department and men responsible for fixing prices follow this policy of the management.

"Payment by Results," by Mr. Powell, is a modern reference book to whch we would refer the reader who is interested and would like to study the subject in greater detail.

In connection with planning, one should be very careful to include only such operations as are included in the category of direct productive labour and not to put in allowances to cover indirect labour such as cranemen and slingers, miscellaneous shop labour, &c., whose time cannot be booked to particular orders, but rather to charge these in the factory expense account under definite headings so that the total expenditure on these items can be carefully watched. If they are booked into orders in the shop and thus distributed over a large number of jobs they may be entirely lost sight of on each particular order, whereas assembled as a total under such a heading as "slingers," "labourers," &c., in factory expenses accounts, they are shown up as a big item and are very much easier to scrutinise, especially if returns are made month by month within a short time after the end of each month.

In connection with planning, under this general heading we would like to include the question of arrangements for completion of work to delivery date. This is a matter of great importance to economical production. Unfortunately, however, the programmes of works are frequently materially disorganised, due to the fact that the materials from outside suppliers are not delivered by the dates for which they are asked. We would impress, therefore, on all purchasers the importance of fixing proper delivery dates, but this policy can only be followed if all manufacturers take special steps to ensure that the delivery dates asked for are faithfully kept, otherwise the purchaser will probably ante-date his requirements to allow for possible late delivery on the part of the suppliers. We would point out that it is not sufficient to set up a system to give delivery dates to the various departments of an organisation; it must be ensured that these dates are kept. Unfortunately, the foremen of these departments often sacrifice delivery

dates to their internal shop convenience or credit; for instance, if it is easier to get a large tonnage output (and so please their superiors) they will do this to the sacrifice of smaller items. These smaller items, however, may be equally important to the users and may delay the completion of very large tonnages. We, therefore, recommend that an important rule in all shops must be, that the delivery dates specified are complied with, for we can assure our readers that this is a very important point in efficiency of manufacturing generally, as the non-delivery of the small materials before referred to may disorganise the whole manufacturing programme of a large works, and possibly even cause a break in the continuity of employment of the workers in that factory.

Standardisation.

Just one note to the users of manufactured articles. We would impress upon them the value of standardisation, even to the sacrifice of their own particular ideals.

Manufacturers should carefully consider the possibility of a market before embarking on development, for when one considers the number of designs, for instance, of electric motors that can be obtained in this country to operate on the same supply and do the same work, and realises that every one of these designs has involved heavy development expenses in engineering, tools, and equipment, the only result being that several firms are manufacturing motors with practically identical performances, in more or less small quantities, one realises the waste in this direction. This curtailment of designs for apparatus to do similar work, of course, must not be carried out to the detriment of the development of an industry, but the cases to which we refer are those in which there is no material difference between the performances, and a relatively small demand for the article.

The Workshop Hands.

We should like now to address a few words to the workmen on the floor of the shops. In the earlier part of our article we recommended the employer to appreciate that the average workman is a good fellow and anxious to do his best in the interests of the industry. On the other hand, the average employer is an equally good fellow, whose interests synchronise with those of the workmen in endeavouring to have a shop continuously full of work, and in these endeavours he does not always consider, as is often claimed, the question of profit, but gives equal, or even greater consideration to the question of providing continuous employment for his workpeople. Our message, therefore, to workmen is to do everything possible to assist the employer to bring business to a successful issue, and if, as individuals, they have grievances, not to allow these to become grudges against the employer, but to bring them to the attention of the management so that it can take steps to deal with the points in question. Of course, where there are works committees the channels exist to carry this into effect, but where works committees do not exist steps should still be taken to acquaint the employer and also to endeavour to persuade him to set up a works committee. There is no doubt that in many workshops things do occur of which the employer has no knowledge, and if the facts were brought to his notice he would take all the steps in his power to prevent them.

Much has been said in recent years on the question of nationalisation, and in this connection we would simply point out that the existing system has brought this great Empire of ours to its present position in the affairs of the world. Admittedly there may be anomalies which require correction, but just because these things do want attention we think it will be appreciated that it is entirely wrong to condemn the whole present edifice of affairs and endeavour to pull it down. One would not think of pulling down the whole house to correct one room, and even if the whole house were wrong, including its foundations, one would not pull it down and take up the foundations without some certain knowledge that one was not facing unknown conditions and possible misery while the foundations were being re-laid and a new house built on the site of the old one. Surely, therefore, it is much better to assist the present order of industry, which, so far, has proved to a certain degree such a great aid to the Empire, thus ensuring further happiness to its great population. Anyhow, happiness cannot be obtained by a "cat and dog" life between employer and employé, but by the closest co-operation between the two parties. More leisure and shorter working hours will not necessarily give more pleasure. The greatest asset of life is happiness, and happiness can never come where discontent reigns. Even amongst the wealthy happiness does not always exist. The grasping for the so-called pleasures of civilisation simply whets the appetite for more, and does not necessarily produce happiness. One certainly advises an endeavour being put forward for improvement, but co-operation and tolerance are the only ways along which real headway can be made.

Conclusion.

To summarise the views expressed in this article the writer feels that increased production and decreased unemployment can be produced by:—

1. The revival of our basic industries of iron and steel, if necessary with the help of the Government, by arranging for regular employment and the co-operation of the men in producing at least a pre-determined output.
2. The development of our Empire as a union of States.
3. (*a*) Special attention of employers to the human element, by arranging for labour to share in the prosperity of industry after proper provision is made to cover future possible losses, coupled with (*b*) Efficient organisation in manufacturing and selling, including proper costing and planning to ensure that work is done at the price estimated and that delivery dates are kept.
   (*c*) More efficient distribution of manufactured products, thus reducing the number of people engaged in selling, and transferring their efforts to production.
4. Loyal and willing co-operation of the workpeople with the employer in avoidance of strikes and disputes, thus producing stability.

Artificial Daylight.—The first of a series of three Cantor Lectures on colour problems was delivered at the Royal Society of Arts on November 24th by Dr. Louis C. Martin, lecturer in the Department of Optical Engineering and Applied Optics of the Imperial College of Science, South Kensington. After dealing with the study of radiation and the general physical aspect of the problems concerned, the early attempts at and modern developments in artificial daylight were discussed. The great disadvantage, continued the lecturer, of all the methods of correction he had discussed was the waste of a considerable amount of unwanted light—the excess energy of the longer wave-lengths. For units giving a reasonably accurate correction, a total efficiency of from 15 to 20 per cent. must be considered to be a good performance. Where only partial correction was required, efficiencies up to 60 per cent. could be obtained, and this method of procedure was recommended for shop-window lighting when it was not desired to obtain absolutely accurately colour correction. Similarly, it was suggested that colour correction lamps might be adopted in picture galleries and thus enable them to be kept open in the evening, for it was absurd to close them at sunset when so many people could only visit them in the evening. In this connection it was emphasised that we in this country had not yet made the use of artificial daylight that we might.

Finally, it was mentioned that one of the psychological factors against the use of artificial daylight was the cold quality of the light as compared with ordinary artificial light, and it should not be forgotten that when one shop window in twenty used artificial daylight at night, the general appearance was judged by eyes accustomed to ordinary illumination, with the result that even a slight correction seemed very drastic. A shopkeeper should not tolerate a lamp bulb giving—as many did—an apparently greenish appearance to the general effect. Probably a lamp with a light cobalt glass would give the required increase of value to the blues in the display without producing an undue coldness of the light. For accurate colour matching, the eyes must be given time to adapt themselves properly to the light from the fully-corrected units, which probably required several minutes. The requirements for window lighting were thus totally different from those for producing the normal daylight effect.

Wiring Rules and Regulations.

By "HOPEFUL."

THE rapid development of the use of electrical energy for all purposes has brought with it a demand for the adoption of some means of ensuring that the reputation of the industry, built up as it is upon sound principles, is not jeopardised by the employment of inferior material and careless workmanship on the part of those connected with domestic and general installation practice.

The advisability, or otherwise, of instituting and applying enforcible rules and regulations to accomplish this purpose has long been occupying the minds of our leading engineers, and it is significant to note that, notwithstanding the efforts on the part of the I.E.E. Wiring Rules Committee in the matter of bringing before us the latest official publication of their recommendations, opinion is still far from united on the subject, with the result that the industry as a whole seems to be little better off for the amount of time and thought expended in its compilation.

This fact is being continually brought to our notice both through the medium of the technical Press and also in every-day life, where the paths of installation inspectors, contractors, and wiremen are beset with problems which call for some definite and fixed ruling, which would settle once and for all the doubts and misunderstandings unavoidable under the present system.

It would appear that the first step towards a complete solution is for our engineers to bring themselves to agree upon some definite line of action, either by the formation of a representative body of the interested parties or else through the agency of one of the recognised institutions. It may be argued that the existence of the present Select Committee of the I.E.E. should suffice to meet this purpose, which is, of course, quite reasonable, but, as already pointed out, the recommendations contained in the "Regulations for the Electrical Equipment of Buildings," as issued by this body, fail to find acceptance at the hands of many of those from whom we might expect the utmost support.

Neglecting for the moment the practical adaptability of these regulations and considering only their purpose, one is brought to the inevitable conclusion, that unless all concerned are prepared to give assured observance thereto we may as well be without them, since to the best of the author's knowledge they are in no sense legally binding upon any party.

Now it is obvious that "rules and regulations" which are not enforcible by law cannot, strictly speaking, be termed such at all. They simply boil down to recommendations, which is something altogether different, and leaves a wide margin for argument on the part of those few who, for the sake of securing a contract, stake both their own and the good name of the industry on a cheap and "shoddy" job, which in a short while will prove a source of trouble, annoyance, and expense to the consumer.

Such a practice, if allowed to continue in respect of any particular locality, has a twofold adverse effect: first, those contractors who would do, and prefer to do, sound work find themselves so undercut in price that their only alternatives are either to bring down their own prices at the expense of the quality of the work or "shut up shop."

Secondly, the impression created in the public mind as a result of one or two failures or breakdowns is in no wise conducive to much progress being made or maintained.

We know only too well the publicity usually afforded to slight conflagrations for example, whether or not directly traceable to the "fusing of an electric wire" makes little difference provided the premises are "wired" (if only for bells), and whilst it is not claimed that complete immunity is in all cases procurable, it is maintained that it is the duty of each and every one of us who has the interests of the industry at heart to remove as far as possible all justification for such assumptions by ensuring that consumers' installation work is carried out to some set standard, which will protect the interests of supply authorities, contractors, and users alike.

Fortunately, the majority of "cheapjacks," by reason of their own calling, enjoy but a short span of existence in our midst, but it is as well to remember that a certain section of the public will always be enticed by an undercut price, which, taking into account the comparative ignorance of the non-user of electricity, is only business after all.

The point at issue is not so much the employment of stringent rules and regulations which might if adhered to, to the letter, constitute needless restrictions and thereby perhaps increase the cost of contracting work, but rather to instil into the mind of the public an impression of security, perfect safety, and reliability of the various domestic devices made possible by the use of electricity rightly applied.

In other words, our efforts should at all times be directed towards making our commodity an absolute necessity rather than a convenience and luxury.

The consummation of this happy state of affairs can, without doubt, be considerably hastened by taking reasonable steps to eliminate the possibility of minor faults and other trouble occurring traceable to the causes already indicated.

In passing, it may be of interest to note that the I.M.E.A. has expressed itself in favour of the compulsory recognition of a set of rules, but what form these would take or the manner in which they would be enforced does not appear to have been made clear. Whatever decision may be eventually arrived at in the matter, too much emphasis cannot be laid upon the absolute necessity of making such rules simple and easily understood, and also incapable of interpretation in any other sense than that originally intended by the compilers.

All long rambling clauses from which all the significant matter can be extracted and comfortably written on the back of a postage stamp should find no place at all. And they should further contain nothing outside of what is necessary to secure adequate protection from shock, risk of fire, or rapid deterioration of materials.

It is extremely doubtful whether such rules as these would in any way touch costs, since the conscientious man already doing good work would be unaffected thereby, and doubtless would in fact, together with other parties concerned, welcome such a measure.

The author, who for some years has been keenly interested in the problem from the supply undertaking's point of view, has often been struck by the hopeless chaos occasioned by the widely diversified opinions as expressed in the rules set up by individual suppliers themselves, which rules they seek to enforce upon wiring contractors. It is remarkable that the legal side of this is so infrequently questioned, and it would be extremely interesting to know exactly to what extent an undertaking is entitled to press for compliance. Unless the writer is very much mistaken, their powers in this respect are limited to a degree quite unimagined by many.

Exception is made in the case of those rare instances where by reason of statutory powers, early obtained, certain undertakings may demand the observance of regulations which are thereby made compulsory; but otherwise, provided an installation does not, on test, fall below a standard necessary to maintain

satisfactory operation of the system, or the supply to other consumers, no action can legally be taken on their behalf, whatever the quality of the work may be.

Further, it would appear that under the present *régime*, the sanction of the Electricity Commissioners would be necessary before anything in the nature of "by-laws" could legally be put into effect, and it is pretty safe to assume that this body would be the last to approve of measures which would in any way be restrictive in nature.

Again the fact is not generally recognised that, strictly speaking, an undertaking has no dealings with the contractor at all; its sole business is with the consumer either existing or prospective, except in cases where the suppliers themselves maintain an installation department. In all other circumstances the contractor is merely an interested party. At the same time, if he is carrying out work in different localities widely separated, he finds himself seriously handicapped in preparing and submitting tenders owing to the rules adopted by the various undertakings not being uniform in nature.

Specifications often contain, among other clauses, one to the effect that "the work shall conform to and satisfy the requirements of the ———— Supply Co." What these are have usually to be ascertained; in some instances a good majority are found upon analysis to be mere "fads" based upon antiquated and obsolete notions. Is it not time that all this was ruled out and a recognised standard set up whereby everyone would know exactly where he stood? Until this is done, it is abundantly clear that the harmonious relationship and mutual understanding between these parties that is so essential to progress cannot possibly be brought about.

Having advanced a plea for the adoption of a set of simple, understandable, and enforcible common rules, it only remains to consider by what means these could be put into practical operation.

Here several difficulties present themselves, among the chief of which may be mentioned: Who is to be responsible for seeing that the conditions as laid down are satisfied, before connection is made to the service mains?

The supply authorities may, quite reasonably it is true, take the view that by undertaking such a task, they are not only laying themselves open to the possibility of being occasionally involved in unpleasant or even legal proceedings, but also that experienced and trustworthy men would be required to do nothing else but inspect and pass the work, thus increasing the overhead charges by the payment of extra wages from which no apparent monetary return can be looked for.

Whilst all this is in a sense true, there still remains the fact that however lax a concern may be in the matter of inspection, someone usually has to call and make a test of some sort before the current is put on, and the small amount of extra work involved under a standard system should not assume such proportions as to call for special consideration on that score. This, however, is of course, a matter upon which the author is open to conviction. Sufficient to say that given the necessary powers he can see no reason why the test and inspection could not be satisfactorily carried out by this body in a manner acceptable to all, and in any case the net result could be no more injurious to it than the present method which, as already pointed out, is full of pitfalls into which the best of us are apt to tumble at times.

Whether or not the regulations set up by the I.E.E. Wiring Rules Committee meet and satisfy all requirements as they stand is a question best left out of discussion here; the fact that they have been adopted and accepted as general practice by the list of insurance companies and supply undertakings shown in the commencing pages of the eighth edition is clear evidence that if they are not altogether acceptable in some quarters, a great number of responsible engineers and public bodies are fully alive to the need for such rules and their practical application.

In the foregoing an attempt has been made to treat the matter broadly from all points of view, and it is hoped that the whole question will in the near future be sifted out and be regarded as at least of equal importance to that of the standardisation of voltage and frequency, about which we have heard so much of late.

Electrical Progress in Latin America.

(From Our Special Correspondent.)

AN important concession has been granted in Brazil for the sale of electric light and power, the chief districts affected being those in and around the city of Aracajú, in the State of Sergípe. The main contract entered into provides for 50-year exclusive rights, the contracting company (Almeida & Co., representing the Société Motores Siemens-Schückert, S.A.) undertaking to install two additional generating groups with a total of 1,200 h.p., and to increase the capacity of its present plant to supply any demand for electric power which the city of Aracajú may require. According to the terms of the contract, work must be started within six months of the date of the concession and finished 18 months thereafter.

A new power station has been established in Bucaramanga (Colombia) by the electric light company of that city for the purpose of increasing the light and energy already supplied to local industrial establishments. An important and far-reaching contract has also been entered into between the Colombian Government and the Marconi Company, whose representative has been in that Republic for the past 18 months for the purpose of securing valuable concessions. It is understood that these have been granted with little difficulty, and the operations of the Marconi Co. in Colombia are likely to become of lasting importance. A recently issued Executive Decree establishes the combined service of the Government telegraph lines and the wireless telegraph stations administered by the Marconi Co.

In the same Republic radio apparatus is meeting with a considerable demand, many of the interior towns having established radio clubs.

A radio service has been established in Bolivia by the General Telegraph and Posts Administration. With the aid of foreign electrical engineers the Minister of Posts and Telegraphs has constructed a receiving and transmitting radio apparatus between the Viacha station, an important railway terminus, and another in Santa Cruz. The installation has already proved of considerable value in improving the communication between these two points and the city of La Paz, as well as other parts of the Republic. Within recent weeks a new company has been organised in La Paz, with capital amounting to 3,200,000 bolivianos, for the purpose of developing the telephone service and electric light and power, the latter mainly in connection with the extended street-car service.

In the small Central American Republic of Costa Rica, Dr. Carlo Cerconi has placed a contract with the Compañia Nacionál Hidro Eléctrica for the construction of a dam, sluice-way and pressure-tank destined to increase the capacity of the electrical plant which furnishes light to the capital (San José). The Compañia Nacionál de Hidro Eléctrica is an amalgamation of two smaller companies owning plants at San Antonio de Belén, Porrosatí, and Hatillo and a local telephone company. The new concern has been formed with a capital of $1,000,000 gold (£200,000), and holds a concession

enabling it to operate a practical monopoly for 25 years. It is worthy of note that the company has been financed entirely in the Republic; this is regarded as a stimulus to national electrical progress.

In Cuba, the Camagüey radio station, which uses a 700-metre wavelength, is now in full working order, and is operating without a hitch.

In Mexico, a powerful radio-telephone receiving and broadcasting station has been opened at Chihuahua, under the direct auspices and with the financial support of the State Government. The station supplements the radio-telegraph station already established in that city by the Federal Government five years ago. The Bureau of Communications now has 29 radio-telegraph stations in the Republic. The most powerful is that at Chapultepec, Mexico City, which is equipped with a Telefünken 200-kW system, and sends on a wavelength of 4,500 metres. This station has been heard in Europe and South America, its daytime range being placed at 13,000 km. In the course of 12 months the number of radio messages sent out was 303,415.

The Sociédade Radio Educadóro de Sao Paulo, Brazil, has decided to erect and equip a radio broadcasting station in that city at a cost of 500,000 milreis. But for the recent riots, now said to be quelled, a commencement of this enterprise would have been made. The whole of the plant and machinery has been ordered, and is expected to arrive in Brazil shortly.

Active progress is being made in the Republic of Panamá in respect of the erection of radio stations. In order to complete communications with North, South, and Central America, the United Fruit Co., an enterprise in which a considerable amount of British capital is invested, and the Tropical Radio-Telegraph Co., are now installing at various points six transmitting stations provided with new 20-kW radiotron tubes, manufactured by the General Electric Co. (U.S.A.). The six new stations now in hand will be erected at New Orleans and Miami, in the United States; Puerto Barríos, in Guatemala; Tegucigalpa, in Honduras; Managua, in Nicaragua; and Almirante, in Panamá. With the exception of the stations at Puerto Barríos and Almirante, which are under the United Fruit Co., the stations are being erected and will be controlled by the Tropical Radio-Telegraph Co. It was believed that the complete system would be in operation during October or November.

The Minister of the Interior and Agriculture of Salvador has granted a contract for the building of a 3,500-h.p. hydro-electric plant on the Rio Grande, at Mirazalcos Hacienda, near Juayuá, in the Department of Sonsonate. The plant will furnish public and private electric light and power in the Departments of San Salvador, La Libertád, Santa Aña, Sonsonate, and Ahuachapán, the contract running for 60 years. In other directions hydro-electric power is making considerable progress in the Republic of El Salvador. This is easy to understand having in view the fact that the country possesses no coal, while the forests are being rapidly depleted of their once-great timber values. Owing to the scarcity of fuel, a large number of productive gold-mines have had to be closed down. The possibilities for the development of hydro-electric power at comparatively small cost appear to be excellent in this progressive and largely-populated Central American Republic.

In Chile, the Compañia Radio Chiléna, a recently-organised undertaking, formed of radio enthusiasts, has erected in the capital, Santiago, a new 600-W broadcasting station. From this there is now being transmitted daily a programme of stock-exchange quotations and other commercial information. This is sent out in the morning, while in the evening literary and musical programmes are organised. The same company proposes to install a new transmitting set which will reach all points of the Republic, as well as to erect two additional stations, one in the south of the country, at Temúco, and the other at Antofagasta, in the nitrate region.

The sale of electrical apparatus and equipment in Chile is showing a marked improvement month by month. This is largely due to the enterprise of foreign manufacturers (exclusive, however, of British firms), who have entered upon a consistent advertising campaign. Although British manufactures, where known, have proved popular, the market for supplies and equipment of all descriptions seems to be largely in the hands of American manufacturers, who continue to furnish by far the most important portion of the requirements; these are expected to increase rapidly, both in quantity and value. An agreement existing between the sellers of incandescent lamps has recently been discontinued, and it is believed that, once released from the restrictions that were in force against the advertising of lamps, these will enter the Chilean market in greater quantities. The improved broadcasting in the Republic has also stimulated the demand for radio equipment, which each month since the commencement of the present year has shown remarkable increases. While French and German apparatus is entering fairly well, the largest demand is in connection with United States manufactures, owing to the fact that much more enterprise is displayed in advertising American apparatus.

The Peruvian Government, through the Posts and Telegraph Department, has granted authority for the construction of a high-power radio transmitting station on the outskirts of Miraflores, in the Province of Lima, and also a receiving station in the vicinity of La Magdalena, in the same province. Final arrangements are being made by the Peruvian Broadcasting Co., of which the Marconi Co. is a stockholder, while an agreement has been made with the owners of a new hotel under construction in Lima to secure roof space for the installation of the station. The Peruvian Broadcasting Co. holds an exclusive concession from the Government for broadcasting.

New Electrical Proposals for Parliament to Consider.

We publish below a list of proposals that will come forward in the next session of Parliament (1925). Readers who are desirous of obtaining further information will find the notices published in full in the *London Gazette* for November 21st and 25th.

(a) Electric Light and Power.

Bath Corporation.—Further powers with regard to the electricity undertaking, including establishment of showrooms; further financial provisions.

Bedfordshire, Cambridgeshire and Huntingdonshire Electricity.—Authority to incorporate a company for the purpose of generating and supplying electricity for all purposes in the counties of Bedford, Cambridge (including the Isle of Ely), Huntingdon, and the urban district of Newmarket in the County of Suffolk. Power to construct, maintain and use generating stations on lands in the parish of Little Barford in the County of Bedford; powers to supply electricity in certain cases beyond or for use beyond the area of supply, &c.

Bexhill Corporation.—Further powers with regard to the electricity undertaking and the supply of electricity; further financial provisions, &c.

Great Yarmouth Port and Haven Commissioners.—Powers to construct a new bridge across the River Yare in place of the existing Haven Bridge; to authorise the Commissioners to work the opening span of the new bridge by electrical or other power, and to require the Great Yarmouth Corporation to supply electrical energy on special terms therefor; powers to the Yarmouth Corporation to construct new tramways, &c.

Mansfield Corporation.—Further powers with regard to the electricity undertaking; powers to maintain and run omnibuses within and without the borough, &c.

Newport Corporation.—Further powers with regard to the electricity, tramway and omnibus undertakings, and the running of motor omnibuses beyond the borough; further financial powers, &c.

Oldham Corporation.—Further powers with regard to the electricity undertaking, including the provision of electrical sub-stations; to authorise the transfer by agreement of certain electricity undertakings to the Corporation, and the supply of electricity by the Corporation in certain areas outside the borough; powers to provide and run trolley vehicles on all tramway routes existing and authorised within the borough and in the urban districts of Chadderton, Lees, Crompton and Royton; powers to provide and run omnibuses within and outside the borough; powers to alter and increase the maximum fares of the tramways of the Corporation and of the tramways in the urban districts of Crompton, Royton, Lees and Chadderton; to authorise the Corporation to purchase the tramways in those districts and the Middleton Light Railways; further financial provisions, &c.

South Wales Electrical Power Distribution Co.—Removal of restrictions upon the placing of electric lines above and below the surface of the ground; application to County Councils of Section 21 of the Electricity (Supply) Act, 1919; and the repeal of certain enactments in the company's Act of 1900.

Stockton-on-Tees Corporation.—Powers to extend the area of supply so as to include the townships of Preston and Egglescliffe, in the rural district of Stockton; further powers with respect to the supply of electricity in the extended area; power to enter into agreements for the supply to the Corporation of steam, waste heat or electrical energy on such terms as may be agreed, including the transfer of part of the Corporation's electrical plant; further financial provisions, &c.

Uckfield Gas Co., Ltd.—Powers authorising the dissolution of the Limited Company and incorporating a new company for supplying gas and electricity within the urban district of Uckfield and district.

(b) Electric Tramway, Motor-'bus and Trolley Vehicles.

Barrow-in-Furness Corporation. — Provision equipment and working of trolley vehicles within and without the borough; provision to run omnibuses within and without the borough; further provision with regard to the tramway undertaking; abandonment or discontinuance of certain tramways; further provisions with regard to the electricity undertaking, including provision as to the sale of fittings, &c., and charges for (amongst other things) stand-by supplies; further financial provisions, &c.

Blackpool Corporation. — Construction and working of new tramways, powers to run omnibuses outside the borough, further provisions with regard to the tramways, omnibus, and electricity undertakings; further financial powers, &c.

Bolton Corporation. — Provision and working of trolley vehicles and omnibuses within and beyond the borough; further financial powers, &c.

Bradford Corporation.—Further powers with regard to the railless trolley vehicle undertaking; further financial powers, &c.

Burnley Corporation. — Construction of new tramways; further provisions with regard to the tramway undertaking; powers to run omnibuses within and beyond the borough; construction and maintenance of an electricity generating station within the borough; further provisions with regard to the electricity undertaking, including the provision of sub-stations under streets, the sale of apparatus and fittings, the establishment of showrooms, &c.; provision for extending the area of supply of electricity within certain areas proposed to be added to the borough; and provisions for the purchase of any existing electricity works therein and for repealing or revoking the powers of other persons in regard to such supplies, including the powers of the Padiham Urban District Council, the Burnley Rural District Council, and the Lancashire Electric Power Co.; further financial provisions, &c.

Darlington Corporation.—Provision, equipment and working of trolley vehicles and omnibuses within and without the borough, the abandonment and removal of certain light railways, financial provisions, &c.

Hartlepool Corporation. — Powers to run omnibuses within and without the borough; further financial powers, &c.

Ipswich Corporation.—The provision, equipment and working of trolley vehicles, the abandonment or discontinuance of certain tramways; further provisions with regard to the tramways; powers to construct electrical sub-stations under streets; financial provisions, &c.

Kingston-upon-Hull Corporation. — Powers to construct and work new tramways within the city; to run omnibuses outside the city; provisions as to wires used in connection with wireless telephony, &c.

Leeds Corporation.—Construction of new tramways; provision, equipment and working of trolley vehicles; powers to run omnibuses beyond the city; further provisions with regard to the omnibus and tramway undertakings; extension of the boundaries of the city to include a portion of the parish or township of Adel-cum-Eccup; extension of the Corporation limits of electricity supply to include the added area and to exclude the added area from the limits of electricity supply of the Yorkshire Electric Power Co., and any other company; further financial provisions; repeal of the Yorkshire Electric Power Acts, 1901-10-14-18 so far as they relate to the added area, &c.

London County Council.—Construction, maintenance and working of new tramways in the Metropolitan Boroughs of Woolwich and Lewisham, &c.

Middlesex County Council.—Construction and working of new tramways in the Borough of Acton and the Urban District of Finchley; further tramway powers; further provision as to revision of prices and methods of charge by companies and others supplying electricity in the county, and the extension to the Council of powers relating thereto, including powers under the North Metropolitan Electric Power Supply Act, 1922, &c.

Nottingham Corporation.—Powers to run trolley vehicles within the borough; construction of new tramways; further financial powers, &c.

Rochdale Corporation.—Further powers in connection with the tramway and electricity undertakings, the running of omnibuses within and without the borough, financial powers, &c.

Wallasey Corporation.—Powers for the construction of new tramways; further provisions relating to the existing tramway and omnibus undertaking; further provisions with regard to the running of trolley vehicles; extension of the area of supply of electricity; further financial powers; further provisions with regard to the electricity undertaking, including provisions as to payment for stand-by supplies, provisions as to the erection of posts and overhead wires in streets in connection with wireless telegraphy, &c.

Walsall Corporation.—Powers to run trolley vehicles within and beyond the borough; further provisions with regard to the tramways, trolley vehicles and motor omnibuses of the Corporation; repeal of the provision of the Walsall Corporation Act of 1914, prohibiting the construction and use of a trolley vehicle route on certain roads; further financial provisions, &c.

West Ham Corporation.—Further powers with reference to the tramway undertaking; powers to run omnibuses; further powers with reference to the electricity undertaking; further financial powers, &c.

Wolverhampton Corporation.—Provision and running of trolley vehicles within and beyond the borough; the abandonment or discontinuance of certain tramways and light railways; further tramway provisions; further provisions as to the supply of electricity; financial powers, &c.

(c) Miscellaneous.

"Daily Sketch" and "Sunday Herald."—Powers to maintain and use in the City of London and the Metropolitan Boroughs of Holborn and St. Pancras a pneumatic tube or tubes commencing in Gough Street (St. Pancras) and terminating near the point of junction of Farringdon Street and St. Bride Street, E.C.

Southern Railway Co.—Powers to transfer and vest in the company the undertaking of the East London Railway Co., and to provide for the winding up of the latter company, increase of capital, &c.

Standardisation of Colliery Requisites.—A meeting of the B.E.S.A. Sectional Committee on Colliery Requisites was recently held, under the chairmanship of Mr. Evan Williams, the president of the Mining Association of Great Britain, principally to report progress made since the inception of the work in June last. Reports, together with detailed recommendations, were presented from the six Regional Committees. The Sectional Committee nominated the following gentlemen as permanent chairmen of the Regional Committees:—Birmingham, Mr. Norman Forrest; Cardiff, Mr. G. D. Budge; Glasgow, Mr. Mark Brand; Manchester, Mr. Jesse Wallwork; Newcastle, Col. W. C. Blackett; Sheffield, Mr. H. Eustace Mitton. A report is being prepared in South Wales regarding electrical apparatus which should be simplified, and this will be considered by each regional committee before the proposals are submitted to the Sectional Committee; in this connection the co-operation of the Association of Mining Electrical Engineers will be most helpful. Realising the importance to the mining industry of the quality of the materials used, it has been decided to set up a national sub-committee, drawing its members principally from each of the regional committees, to consider this important subject and make recommendations as to the materials for which specifications should be put in hand. Reference was also made to the useful results obtained from the discussions of the address given by the Secretary in the principal coalfields.

Power Production on St. Lawrence.—The Ontario Municipal Electric Association has condemned the delay of the Dominion Government in approving the plans of the Ontario Hydro-Electric Commission for power development at Morrisburg, on the St. Lawrence river. It also condemns the proposal of the Canadian Deep Waterways Association that St. Lawrence power should be developed by the Federal Government. The Hydro-Electric Commission offers to spend 40 million dollars (£8,000,000), half the amount required for building the dam at Morrisburg, on condition that the other half shall be furnished by the State of New York or private power companies.—*The Times.*

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Glowincoal" Fire.

It is evident that the imitation coal fire with electrical elements has found favour in the eyes of the public from the number of designs which are now available. One of the latest of these is the "Glowincoal" fire (fig. 1) made by ELECTRIC HEATING & HARDWARE, LTD., Crown Works, Berkley

Fig. 1.—The "Glowincoal" Electric Fire.

Street, Birmingham. The body of this fire is of cast aluminium with a bright finish, no lacquer being used. The coal is claimed to be as like the "real thing" as possible. The loading can be either 2¼ or 3 kW, and separate switches are fitted for each bar. The curved reflector back is another form of design which has attained popularity in the last two or three years.

A New "Cantie" Switch.

THE CANTIE SWITCH CO., LTD., Leighton Street, Carlton Road, Nottingham, has introduced a double-pole change-over switch possessing several novel features. The top and bottom

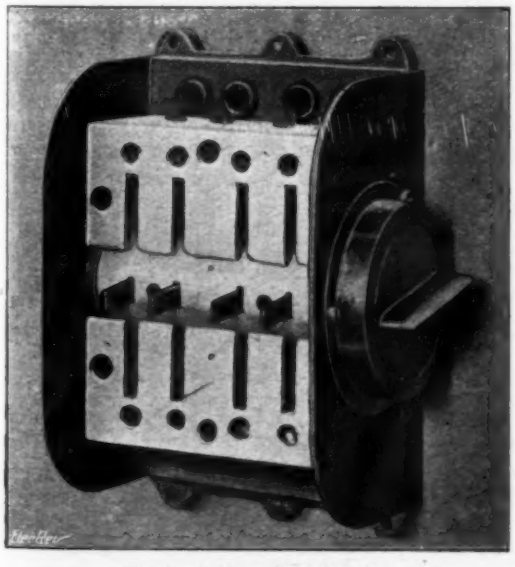

Fig. 2.—A New "Cantie" Switch.

fixed contacts and their holding screws are shrouded in an exceptionally complete manner in vitreous china so that even when the cover is off it is impossible to touch any "live" part. The moving blades are mounted on a rotating vitreous china cylinder operated by a spring quick-make and quick-break handle upon which the position of the blades is indicated. The side pieces and cover are of sheet steel, and the gear is mounted on a substantial cast brass (or gunmetal) back frame; a general view appears in fig. 2. A sample which the firm has sent us has undergone some very severe tests and has successfully withstood them all. The first, mechanical, test consisted of making and breaking the switch (not under load) for ten days of nine hours each (496,800 breaks). A test at 6,000 V showed no leakage, and then the switch was put into a highly-inductive 220-V circuit, where it broke a current of 18 A 165,600 times with no perceptible damage. At Faraday House it broke currents of 30 A at 200, 400, 500, and 600 V. The Falkirk Iron Co., Ltd., also made a number of severe tests upon the same sample, which was shown on the company's stand at the British Empire Exhibition for some time.

A Variable-speed Motor.

An electric motor that will run at an infinitely variable speed between zero and maximum, while exercising constant torque, and one, moreover, with less loss than results from rheostat control, has been invented and patented by Mr. P. T. KING, of 15-17, Manchester Street, Luton, Beds. The distinctive feature of this invention is the mounting of the field magnet and armature in such a manner that either part is free to rotate. The essential components are the revolving field magnet with its combined slip rings and brakes, the revolving armature, with its brake drum at one end and a driving pulley at the other, and a hand- or foot-controlled lever which eases the pressure on one brake drum while increasing it on the other. Current is led into the machine through two insulated slip rings (which are secured to the outside of the cylindrical field casing) by means of carbon brushes. These brushes are raised and lowered by means of

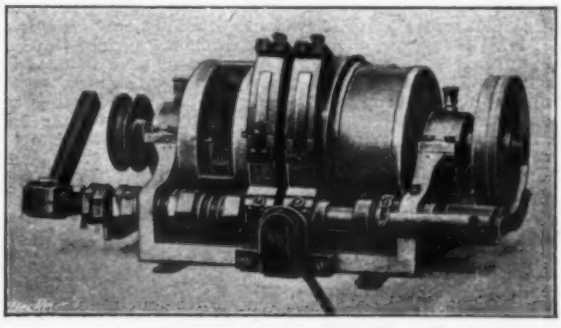

Fig. 3.—King's Variable-Speed Motor.

the lever seen to the left of the accompanying illustration, fig. 3, and function primarily as a double-pole switch, and secondarily as brake blocks. Besides fulfilling the office of slip rings and collectors the pressure of the brushes acts as a brake on the outer rotating member, that is, the field magnet, the speed of which can therefore be regulated by the pressure exerted by the lever to which the brushes are fixed. A "Ferodo"-lined brake acts with the brushes and is operated by the same lever. It is obvious that if the fields are held stationary, the armature will revolve at full speed, while if the armature is held the field will rotate instead. Equal braking effect on both these parts will result in the armature rotating in one direction while the fields rotate in the other, each at half speed relatively to the fixed frame. A brake drum is therefore attached to an extension of the armature shaft seen on the right of the illustration, while another brake block bearing upon this is actuated by the same lever that brings the brushes down on to the slip rings. The respective brake blocks attached to the lever are so adjusted that as the pressure on the field magnet slip rings increases that on the armature brake drum diminishes. The amount of "slip" upon either component (armature or field) can therefore be regulated by the position of the operating lever, and consequently the speed at which the armature revolves can be controlled with exactitude, according to the permitted degree of slip; the magnetic speed between field and armature thus remaining practically constant whatever the extent of their respective slip as regards the fixed cradle may be, the full counter-electromotive force generated in the armature is maintained, resulting, it is claimed, in much more economical running conditions than can be obtained by any rheostatic method of speed control.

A Mica-Cutting Saw.

MESSRS. FRY'S (LONDON), LTD., 46, Upper Thames Street, E.C.4, have sent us a sample of a little hack saw, 1¼ in. long, intended for the cutting down of mica in commutators.

The Use of Electricity in Coal Mines.

Abstract of a Joint Discussion in Scotland.

A JOINT meeting of the members of the Mining Institute of Scotland, the Scottish Branch of the National Association of Colliery Managers, and the West of Scotland Branch of the Association of Mining Electrical Engineers was held in Glasgow on November 22nd. Mr. D. C. Gemmell (president of the Scottish branch N.A.C.M.) presided, and he was supported by Mr. J. A. B. Horsley (H.M. Electrical Inspector of Mines), who had been announced to read a special paper on "The Use and Abuse of Electricity in Coal Mines," and by Prof. R. W. Dorn (president of the Mining Institute of Scotland), Mr. David McQueen (president of the West of Scotland branch of the Association of Mining Electrical Engineers), Mr. John Masterton (H.M. Inspector of Mines for the Scotland division), and Messrs. A. B. Muirhead and Frank Anslow (Glasgow), with Mr. Thomas Borland (West Calder). The attendance was well in excess of 500, and the meeting will rank as one of the most representative in the history of Scottish mining.

The CHAIRMAN remarked that the industry with which he supposed they were all connected, directly or indirectly, was passing through a very severe crisis at the moment. The situation was indeed such that colliery managers and mining electrical engineers must adopt every labour-saving and cost-reducing device at their disposal, and electricity presented itself as a medium by which these costs could be lowered, consistent always, of course, with efficiency *v.* safety.

Mr. J. A. B. HORSLEY prefaced his paper by remarking that he did not know whether they had met to praise Cæsar or to bury him. The title of his paper might appear to be a strange one: Electricity, however, being a willing horse in the sense that it did not readily rebel against a dose of overwork, and modern electrical apparatus being so robust that it continued to function with a modicum of attention, it almost inevitably followed that legitimate use occasionally degenerated into something not altogether distinguishable from abuse. They were all aware of the increasing use that had been made of electricity in mining, but some of them might not know the exact increment. He exhibited three charts illustrating the growth in the application of electric power above and below ground since 1912, which told their own story. They might draw conclusions not unfavourable to the enterprise of Scottish mining engineers from the third chart, and it would be impossible for the coal mines of the country to be using more than 1¼ million horse-power in electrical motors if the apparatus was not dependable. Improvement in design had been radical and had kept pace with, if, indeed, had not been the reason for, the growth in the use of electrical equipment. The British manufacturer had been charged with unwillingness to adapt his goods to the market, but he (Mr. Horsley) had found him, in the electrical field at any rate, exhibiting not only flexibility in meeting the needs of the moment, but possessing a prescient anticipation of things to come. If the manufacturer should happen to show a tendency to "lead the field" by introducing new features into his designs, he was suspected of a disingenuous desire to dip his hand into the pocket of the purchaser under a camouflaged plea of "improvement." When electrical engineering had arrived at the stage where improvement was no longer possible, or perhaps was unwanted, it would have descended to the level of plumbing—a skilled handicraft, but not a scientific adventure!

The moral was that it behoved them all to move with the times and to be discontented with the standards which survived in pioneer days. Quite recently, when discussing a paper before one of the major institutions, a prominent mining engineer declared that for the third time during an unspecified period the colliery with which he was connected had replaced its electrical installation in order to meet new statutory requirements. Mr. Horsley imagined that the mining engineer referred to had indicated transition through the three periods, which might be described as the ages of "no regulations," "unarmoured cables," and "armoured cables." He suspected, however, that while he thus threw the responsibility for the change upon the law, he would have been quite willing to admit that each institution spelled progress and resulted in the acquisition of plant better fitted to meet mining needs. A hint of the presence of a ruffian round the corner, armed with a club, may be a more potent persuader than the most elaborate technical argument, on occasion, to induce the untying of reluctant purse strings. Electricity was differentiated from other agents for the transmission of power by the simplicity and accuracy with which measurements could be made, but unless the results of tests were recorded they lost much of their prospective value, for "insulation" and "conductivity," to use two simple illustrations, were but comparative terms. All records should be reduced ultimately to a summarised and condensed form so that comparison and reference were easy. If a particular motor, switch, or length of cable habitually gave trouble, a precise record of the case might enable an expert to diagnose the cause and prescribe the remedy. Such comparative histories of the good and the bad should be available when extensions were under consideration. For summarised records of tests they ought to try the principle of the ledger, with which should be a separate page for each entity so as to make comparison of results easy. For the layout of the plant he suggested the use of diagrams showing the various cable runs, points of control, the size of the conductor, and the length of the cable between each testing point. If each item of plant was given a reference number on the diagram it would be easy and advantageous to add a table summarising the bare essential particulars of the apparatus.

In present-day colliery practice indicating instruments were used freely; chart recorders were rarely installed, and registering meters were found only on the main switchboards of the larger undertakings. A leakage indicator was too often regarded as a mere ornament, but how valuable a chart type recorder could be! On low and medium-pressure systems failure of insulation due to the access of moisture was usually progressive, and the chart would show premonitory "kicks" so that the defect would be looked for and remedied before the insulation gave way altogether. Then more use might be made, with advantage, of portable ammeters to observe the load on particular branch circuits, such as those feeding coal cutters. By studying such records improvements in working could be suggested and misuse of plant checked. In many collieries no account was kept of the quantity of electrical energy generated, and in few was there any knowledge of the quantity used for different classes of service. He was not familiar with colliery costing, nor did he know anything of the relative importance of the various items that contributed to the total cost per ton of coal delivered into the wagon, but he did not doubt that useful economies could be effected in the expenditure upon electric power if accurate information were available. The avoidable loss of power on many haulage roads must be considerable. Manufacturers of electrical apparatus strained after an extra ½ per cent. in efficiency, but the user did not know, in many instances, whether five or fifty per cent. of the power developed was usefully employed. The best safeguard against electric shock was efficient earthing. It was well that humanity was optimistic in the lump, otherwise an invisible earth plate, of which the exact location was not known, and a varied cable connection thereto, of which the continuity was presumed, might lead to acute insomnia! The top of the earth plate should be visible and the cable which connected it to the earthing bus-bar ought to be in sight throughout its length or be so arranged that it could be tested frequently. The electrical conductivity of the ground varied very much, at any rate near the surface, and the earth plate should be tested initially against an independent earth, such as the rising main from the mine pump, and subsequently periodically, especially in periods of drought; for these tests two earth plates sunk well apart were useful.

The connection across joint boxes or similar points where the cable armouring was necessarily cut, in practice was often bad mechanically and doubtful electrically.

Touching on "the wide subject of automatic protection," Mr. Horsley dealt specially with leakage protection, which was now firmly established as standard practice in some parts of the coalfields.

The Court-Rosebourn method of leakage protection for direct-current two-wire insulated systems utilised at the main switchboard a polarised relay connected between an artificially-produced mid-voltage point and earth. If a fault to earth occurred anywhere on the system the relay connected the bus-bar to earth through a current-limiting resistance. If the fault was on the negative pole, the positive bus-bar was put to earth and *vice-versa*; thereupon, the differential relay on the faulty branch feeder came into play and the trip coil cut off the faulty circuit. This method was in use at Plas Power Colliery in North Wales. In conclusion, Mr. Horsley said that better organisation, equipment, and maintenance of the electrical plant in use at collieries was undoubtedly taking place. The increased outlay involved would be amply repaid, he was convinced, not only by lessening such danger as there was now, but by increasing reliability and improving efficiency.

Discussion.

Prof. G. W. O. HOWE (Glasgow), in the discussion that followed, said with regard to improving the condition and status of electrical mining machinery that he personally realised as much as anyone that that could only be accomplished by raising the status of the men in the mines whose duty it was to see that apparatus was properly maintained. He was surprised to notice that in the section of the paper dealing with cables and the sealing of the dielectric, Mr. Horsley did not differentiate at all between rubber-insulated and paper cables. He was pleased to note the stress the author had laid on the power behind automatic cut-outs.

Prof. R. W. DRON (Glasgow University) said that, as Mr. Horsley had pointed out, indicating instruments were freely used, but chart recorders were rarely installed, while register-

ing meters were found only on the main switchboards of the larger undertakings. In drawing attention to that fact the author had put his finger on the weakest spot in the organisation of colliery electrical work. If proper charts were supplied to the management at regular intervals it would result in much closer co-operation to secure improvements, both in safety and efficiency. The development of this branch must lie very much in the hands of the electrician, and he should receive every encouragement in following up Mr. Horsley's suggestions. It was too often the case that the leakage indicator on the switchboard did not get the systematic attention it deserved. The expense caused by one interruption in service might easily be far more than the whole cost of the instruments referred to. When electricity was made at a colliery by the use of exhaust steam and low-priced fuel there was no great incentive to economise the kWh used so long as the plant was capable of supplying all the power needed. The difference in the overhead daily cost which could be effected by economies in the use of the power was almost negligible. If, on the other hand, power was purchased from a company such economies became at once evident in the monthly accounts. These two statements taken in conjunction led him to observe: if a colliery installation could produce surplus power at a very trifling cost, why should arrangements not be made for the utilisation of such power? It would pay the colliery company to sell all surplus power at a very low price, say, 0.2d. or 0.25d. per kWh, and it would pay the power companies to purchase it at that price. An arrangement of that kind would result in very considerable advantage to the country as a whole.

It was agreed that there should be a further joint meeting of the Associations to discuss the salient features of the paper.

Electric Welding with Automatic Machines.

The Cutler-Marsden Welders.

Up to a certain point welding with the electric arc has proved highly convenient and satisfactory, and it has been adopted very widely in the engineering industry, for an extraordinarily varied range of applications. There have been, however, two serious obstacles to its further development: it has been wholly a manual process, requiring skill and intelligence to obtain efficient and uniform operation; and the training of the operatives has been an expensive and lengthy matter.

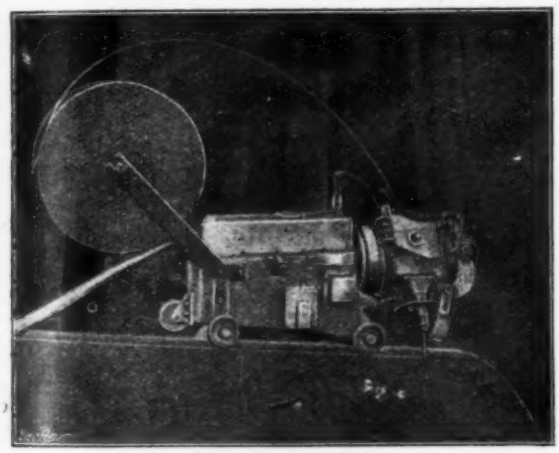

Fig. 1.—The Cutler-Marsden Welding Machine at work.

Attempts have been made to render the process automatic, with a large measure of success in certain applications of limited scope, such as the building-up of worn shafts, &c., which can be made to rotate in front of a stationary electrode; but, so far as we are aware, in no case hitherto has a fully-automatic portable arc-welding machine been extensively employed.

We recently had the privilege, however, of inspecting machines designed on the latter principle, which "run up seams" very much after the fashion of a travelling sewing machine. These machines, though new to this country, have already been used to weld many miles of steel piping in Australia, and are to-day engaged on the execution of large contracts of this nature. They are the invention of Messrs. A. E. Cutler, M.Inst.C.E., and P. A. Marsden, A.M.I.E. (Aust.), of the Government Dockyard, Walsh Island, N.S.W.; the Victorian rights have been acquired by Messrs. Thompson & Co. (Castlemaine) Proprietary, Ltd., of Melbourne, who are applying them to pipe-welding. The machines are also suitable for structural steel work, ships' hulls, boilers, tanks, &c. —wherever a long seam is to be welded.

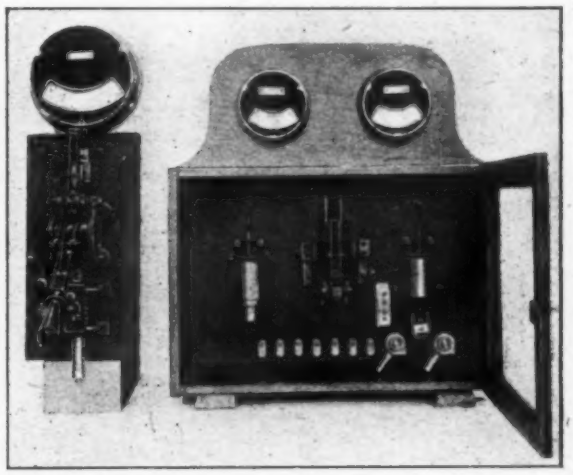

Fig. 2.—The Control Panel and Circuit-breaker.

The essential principles of an automatic seam welder are that it shall maintain an arc of constant length whilst travelling at a suitable speed along the seam and feeding the electrode at a proper rate. These conditions being fulfilled, it is permissible and practicable to use a larger current than is possible with hand welding, and thus to perform the work not only much more quickly, but also much more efficiently and without liability to oxide inclusions.

The Cutler-Marsden automatic welding machine, it is claimed, uses sufficient current to ensure the fusion of the

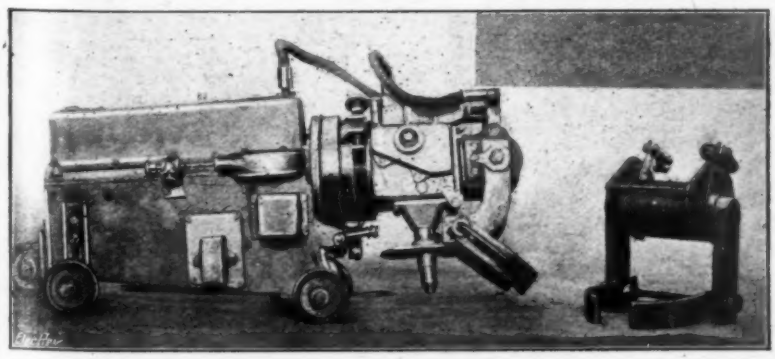

Fig. 3.—Welding Machine and Magnetic Compensator.

Fig. 4.—Photomicrograph of Weld, enlarged 200 diameters.

parts to be welded and their perfect union with the metal deposited, and does this at a rate from five to seven times as fast as hand welding, without requiring skilled labour. The energy consumed is no greater than that used for hand welding, and the electrode is a mild steel wire, uncoated.

Fig. 1 is a view of the Cutler-Marsden fully automatic machine, which looks curiously like an extraordinary species of insect. It moves backwards on four wheels, being guided along the seam by the edge of the overlapping plate, or by a guide rail when butt-welding plates up to 5/16 in. thick (in the case of thicker plates the edges are veed, and the wheels run in the groove without a guide rail). Motion is derived from a motor controlled by the welding current, which also feeds the electrode from a bobbin to the nozzle seen below the head of the "insect," whence the electrode protrudes to within about ¼ in. of the seam to be welded.

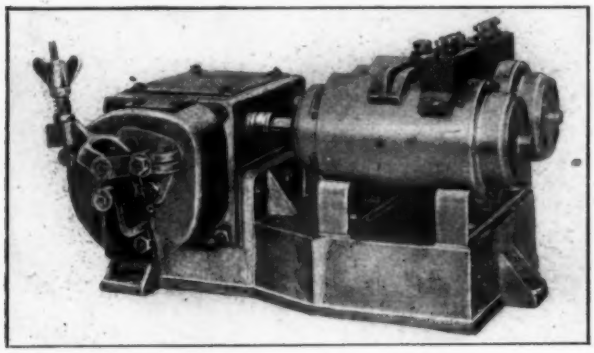

Fig. 5.—The Feed Controlling Gear.

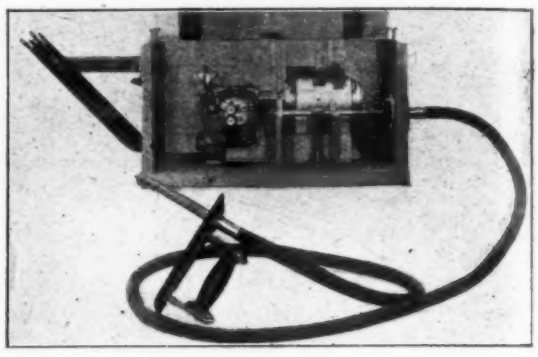

Fig. 6.—Cutler-Marsden Semi-automatic Welding Outfit.

The accessory apparatus used with the automatic welder comprises a circuit-breaker, reactance coil, and rheostat, and a control panel (fig. 2) carrying an ammeter and voltmeter for the arc, a low-reading ammeter for the motor current, a magnetic contactor switch for the welding current, a current limiter for the protection of the motor, a time-limit relay controlling the contactor, two small fuses in the controlling circuit, and condensers to minimise sparking at contacts.

When the electrode has been set ¼ in. from the work and the tip of a copper rod inserted into the gap, a push-button on the machine is pressed and released and the rod is removed, starting the operation. The motor field is excited by a proportion of the main current, whilst the armature is in shunt to the arc; thus the speed of the motor and therefore the rate of feeding the wire is automatically regulated, maintaining the arc at constant length and also controlling the speed of travelling along the seam. If the arc should break or the electrode wire "freeze-on," the control gear would cut off the current from the machine; but such arc failures are very infrequent. Adjustments are provided for the size of wire, feed, and travel, and when a wide weld is required an oscillating mechanism can be set in action. The wheels are also adjustable.

When the arc has been started the machine immediately begins to form the weld, travelling at the rate of about 30 ft. an hour. If a pipe is being lap-welded, the machine travels from end to end on the outside, after which the pipe is turned over and the machine travels through it on the inside, thus welding both edges of the lap. No skilled attention is required whilst the weld is in progress—in fact, one man can easily look after several machines.

If nothing more were needed, the matter would seem very simple; but a difficulty was met with very early in the development of the machine. When welding, it was found that the electrode burnt off in an oblique manner, the sharp point fouling the edge of the crater and short-circuiting the arc. This particularly applied when heavy current values were being used, and for a long time little progress was made. It was noticed, however, that this effect was absent when welding on a solid plate or on a joint previously welded on one side, and this gave the clue which led to success. It was ultimately found that the arc was being deflected backwards by a mischievous magnetic field. It appears that so long as the seam in front of the arc is unwelded, the magnetic field set up in the metal by the arc current passes through the air gap, and causes unbalanced fields to exist on the two sides of the arc, the field on the advancing side being the stronger and deflecting the arc backwards; it is, of course, strongest where the arc is actually playing, and tends to blow the arc away. When one side of the joint has been welded, there is no longer any air gap, the field is practically confined to the metal, and the arc plays correctly and continuously.

The discovery of this action led to the addition of the solenoid which forms the forehead of the "insect," and the two iron pole pieces which form its jaws (fig. 3); by these means a counter magnetic force is set up, resulting in the demagnetisation of the abutting edges of the plates, and the arc is reduced to good behaviour. When, as above mentioned, one edge of the lap has been welded, the auxiliary magnet is not required, and the jaws are pushed aside. This ingenious device put an end to the difficulties that had been experienced, and made the welder a practical automatic machine.

The machines weigh about 60 lb., and are readily portable; they operate in Australia on a constant supply pressure of 40 volts, and have been in regular use on three-shift work.

There are many cases where a fully automatic machine cannot be employed—as, for instance, in welding objects of irregular size and shape, filling up holes in castings, &c. The inventors have met these cases by devising a semi-automatic machine, which reduces the skill required for welding to a minimum. This outfit comprises a controller and a hand tool, the latter being connected by a flexible metallic tube with the controller, as shown in fig. 6.

The object of the apparatus is automatically to maintain the arc constant in length under all circumstances. It is quite impossible manually to feed an electrode at the exact rate to correspond with its burning rate and at the same time correctly form the weld; hence in the ordinary way the arc is continually fluctuating in length, and in the extreme cases the electrode welds to the work or the arc is broken. The Cutler-Marsden semi-automatic machine, however, compensates for these movements in an almost uncanny fashion; whether the tool is moved nearer the work or farther away than the normal distance, the arc length and current remain practically constant. This is effected by the action of the controller, which is sensitive to any change in the voltage across the arc or the current through the arc; should the arc tend to lengthen, the electrode (wire coiled on a bobbin) is rapidly fed forward to counteract the tendency; and if the arc tends to shorten, the electrode is correspondingly retracted. Hence the electrode guide or tool can be moved towards or away from the work, and there is no need

Fig. 7.—Operator welding with the Semi-automatic Outfit.

for the operator to think about the length of the arc at all; his whole attention can be concentrated on the actual welding operation, directing the metal to the right place—in fact, he thinks only in two dimensions instead of three. We have seen the operator look away from the work altogether, and go on welding without breaking the arc.

The controller consists of two motors, suitably interconnected so as to be influenced by the current and arc voltage. The motors are constantly running in opposite directions, and are connected with the feed rollers by a differential. As long as both run at the same speed the differential remains at rest; but the moment one gains on the other, the differential rotates correspondingly and feeds or retracts the electrode wire until the speeds again coincide—*i.e.*, the arc is again normal. The motors being in motion all the time,

their response is so rapid that in ordinary working the arc current and voltage remain practically constant. The controlling gear is shown separately in fig. 5, and a welder at work in fig. 7.

Up to a thickness of 5/16 in. butt joints can be welded without vee-ing, and to a greater thickness when welding on both sides. No trouble is met with from contraction even on long seams. The weld metal is ductile, and is not harder than the parent metal; and the weld can be bent or flanged hot.

A great number of tests of Cutler-Marsden welds have been made by various authorities. Tested at the Melbourne University for the engineer of the Metropolitan Board of Works, Melbourne, two samples of lapwelded steel plates broke with a stress of 23.3 and 29.6 tons per sq. in. respectively, with contractions of area of 57.9 and 51.9 per cent. and elongations of 22.8 and 17.3 per cent. on 8 in. The figures for corresponding unwelded plates were 22.2 tons and 27.1 tons per sq. in. respectively. The fracture was in the body of the metal. Of the 11 tests made on this occasion, none showed a less stress than 22.2 tons, and eight of them were from 27 to 30 tons.

These automatic machines have been used at the Government Dockyards, Walsh Island, Newcastle, N.S.W., for welding many miles of steel pipe, from ¼ to ½ in. thick, and from 9 inches to 7 ft. in diameter.

Numerous tests were made by the official tester, Mr. Horace Allen, A.M.Inst.C.E., A.M.I.E. (Aust.), on butt-welded and lap-welded plates, the breaking stress being rarely below 22 tons and often exceeding 30 tons. Usually the break was in the plate. Butt welds ground flush with the plate gave similar results. A welded plate was heated bright red, bent to a right angle and reversed three times, re-heated and welds swaged down flush, and finally broken by bending cold—the break was in the plate. Ten tests made in Messrs. Thompson's works laboratories on welds made with the semi-automatic machine on ¼-in and ⅜-in steel plate showed tensile stresses from 27 to 33 tons per sq. inch, all breaking outside the weld; the highest stress occurred in a specimen in which the weld was ground flush—33.12 tons/sq. in., with an elongation of 14.3 per cent.

The question of occluded nitrogen is of some importance, and chemical analyses made by Dr. J. H. Paterson, of Newcastle-on-Tyne, are of interest as showing in four samples an average nitrogen content of 0.0849 per cent., carbon 0.056 per cent., sulphur and phosphorus each less than 0.035 per cent.

Fatigue tests have been made by the National Physical Laboratory on butt-welded plates ½ in. thick. Cylindrical test pieces were made, turned down at the weld to 0.3125 in. diameter, and subjected to endurance tests in a rotating bending fatigue machine running at 2,200 r.p.m. Under these conditions it was estimated that six specimens had a fatigue limit of 10.5 to 11 tons per sq. in. These tests were made on a 10,000,000-revolution basis. These results are far above the requirements of Lloyd's Shipping standards. In general, the inventors claim that the welds are 100 per cent. of plate strength, and will stand repeated bending or drawing at a red heat.

The steel tube contracts undertaken by the Government Dockyard, Newcastle, N.S.W., with the automatic welder, up to January last amounted to 203,648 ft., the pipes ranging from 9 to 84 in. in diameter, and from 3/16th to 7/16th in. thickness. Messrs. Thompson have in hand a contract for 120,800 ft. of 30-ft. pipes, 46 and 54 in. in diameter, and from ⅜ to 7/16th in. in thickness.

We learn from the Sydney *Bulletin* of October 9th, 1924, that the Government Dockyard has secured a 3,000-ton order for pipes from the Sydney Water Board, and is engaged also on a large order for the Melbourne Metropolitan Board of Works—both obtained in open competition.

For some time past the Cutler-Marsden machines have been at work for demonstration purposes at Faraday House, London; the patents are owned by Mr. L. D. Grewar, to whom we are indebted for the opportunity to publish these particulars.

Hydro-Electric Schemes.

By A. H. GIBSON, D.Sc., &c.

Abstract of paper read before the MANCHESTER ASSOCIATION OF ENGINEERS.

THE type of turbine to be used in hydro-electric schemes depends largely on the available head. The impulse turbine, represented by the Pelton wheel, is more suitable for heads above about 700 ft.; the pressure turbine for heads below about 250 ft. in small units and below about 400 ft. in large units. Pelton wheels are usually built as horizontal shaft units, with one or two nozzles. If two nozzles are insufficient to give the required power, two wheels may be mounted side by side on one shaft. The maximum size of nozzle jet fitted in any plant up-to-date is 13 in.; the maximum power of any unit is about 30,000 h.p., and the maximum head 5,412 ft. At such a head the velocity of the jet is 580 ft. per second and the peripheral speed of the buckets 250 ft. per second, or 180 miles per hour. Such speeds give rise to very high centrifugal stresses and necessitate high-tensile steel disks, and special arrangements for fixing the buckets. In a well designed plant the instantaneous speed variation corresponding to a sudden application of full load should not exceed from 12 to 15 per cent., while when all the load is suddenly removed the increase should not exceed 5 per cent. With a 50 per cent. change of load the corresponding figures are 6 and 3 per cent. The difference between the initial and final steady speeds should not exceed 2 per cent. between full and no load, and should not exceed 1 per cent. with a 50 per cent. load variation. At constant speed the efficiency of a Pelton wheel falls off comparatively slowly as the load is diminished. A well designed wheel of moderate size should have approximately the following efficiencies:—

Fraction of full load	¼	½	¾	¼	1
Efficiency per cent. ...	77	82	83	84	82

In large vertical shaft machines the weight of the rotating parts of the turbine and generator, together with the downward pressure on the turbine runner is 500 tons in some modern machines, and their design has only been possible by the use of vertical suspension bearings of the Michell or Kingsbury types. In such a machine the mechanical friction losses are only 0.1 per cent. of the normal output in one modern plant.

In a low-head high-speed plant, the draft tube is one of the most important features since, owing to the relatively high velocity with which the water leaves the runner, a large proportion of the energy of the head water is rejected into the draft tube as kinetic energy. In a turbine operating under a head of 10 ft. and discharging with a velocity of 12 f.s., this kinetic energy amounts to some 22 per cent. of the whole energy of the supply, and even if there were no other losses, the efficiency of the turbine could not exceed 78 per cent. To reduce this loss the draft tube is very carefully formed with a section gradually increasing in the direction of flow such that the velocity of discharge into the tail race does not exceed three or four feet per second. In this way some 70 per cent. of the kinetic energy leaving the runner may be converted into pressure energy before the water leaves the draft tube and becomes directly useful in increasing the head acting on the turbine.

The pressure turbine is capable of giving remarkably high maximum efficiencies; 93 per cent. has been obtained on repeated tests of vertical-shaft machines at Niagara, and at least 90 per cent. is quite common. The efficiency at part load falls off somewhat more rapidly than in a Pelton wheel, especially in turbines of the low-head high-speed type. In a medium head plant the following are typical values:—

Fraction of full load	¼	½	¾	¼	1
Efficiency per cent. ...	72	82	88	90	88

For heads up to about 200 ft. reinforced-concrete pipe lines are suitable and have the big advantage of not deteriorating appreciably with age. If suitable materials are available near the site they may be cheaper than steel. For moderate heads wooden pipes are extensively used in countries where suitable timber is cheaply available, and under suitable conditions have a useful life of from at least 25 to 30 years. The range of useful heads is from 20 to 200 feet. For long life it is necessary that the fibres of the wood shall be maintained in a state of saturation and therefore a certain internal pressure is necessary. For this reason wooden pipes are not well suited to heads less than about 20 feet; they have been constructed up to about 18 ft. diameter.

Hydro-electric engineering is a branch of engineering in which great developments are likely to take place in the future. The author, who is Professor of Engineering at Victoria University, illustrated his paper with numerous lantern slides.

Discussion.

Dr. A. H. Gibson was prevented by illness from attending and the paper was read by Mr. Baker.

MR. F. WALKER observed that frequently the objection to schemes for utilising water power was that the cost of attendance was so great. That could be got over very largely by automatic control; it had been used for 30 years in the United States and there were examples of it in this country.

DR. MORLEY remarked that the capital cost involved was very considerable, which fact emphasised the importance of very careful co-operation in any hydraulic power production scheme, and in the selection of the exact point at which the power station should be placed.

MR. D. ADAMSON said that in connection with the development of hydro-electric schemes the problem of distribution was a serious one, and probably it had been most successfully solved at Queenstown on the Canadian side of the Niagara Falls. Transmission schemes had previously been carried out in California, where the atmosphere lent itself to long-distance transmission at high voltages. About 20 years ago they were transmitting over 200 miles in California, so when the Hydro-Electric Commission got to work in Ontario it had sufficient technical data to go upon. Between 300 and 400 small municipalities co-operated, local jealousies and rivalries being sunk for the benefit of the whole. According to a recently published article that Commission had about 3,000 miles of high-pressure transmission lines. Towns not more than nine miles away got their power for from 1.3 to 1.4 cent per kW-hour (about ¾d.); up to 90 miles for from 1.8 to 2.0 cents (practically 1d.); up to 250 miles for 2.6 or 2.7 cents. So the cost of transmission for 250 miles just about doubled the cost of the energy to the consumer. Apart from financial success, it had other satisfactory results; all the small towns retained their individuality and, other things being equal, people preferred to live in a small town if they could get there the benefits usually obtained by living in a large town. Those 300 or 400 small towns now owned the largest municipal electrical enterprise in the world. It was a striking illustration of the value of applying Lancashire methods of co-operation, especially when compared with what had happened in California where the jealousies and quarrels between the publicly-owned undertakings and the private companies had prevented the attainment of similar results.

MR. J. FRITH remarked that electric transmission was the only way in which use could be made of the water power of this country as people were unwilling to build factories where the water was. The electrical end of the problem was the important one; automatic control would only pay with reasonably large water power. In Canada the country was paralleled electrically, which meant that the stations everywhere were going at the same electrical speed, there was no allowance of a variation of from 10 to 15 per cent. If it was synchronous machinery, and most of these stations had synchronous machinery, they must not slip a single revolution. That considerably altered the mechanical requirements of governing and he thought mechanical engineers would have to study the design and manipulation of their governors. A possibility which electrical people were looking into was the use of an asynchronous generator which would make governing much easier. If it could be developed, it would be a much simpler thing than the very complicated time switch gear now required for the usual type of electrical machine.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

12,359. "Telegraphic apparatus for the automatic reception and re-transmission of electric signals." Creed & Co., Ltd., and F. G. Creed. May 8th, 1923. (224,563.)

12,739. "Commutator for direct-currents of dynamo-electric generators and motors." W. Aldred and T. Milner. May 12th, 1923. (224,566.)

15,504. "Wireless signalling systems." R. I. Wells, H. L. Crowther, and N. F. S. Hecht. June 14th, 1923. (224,574.)

20,369. "Testing board for electrical installations." L. Ubrig. September 12th, 1922. (204,026.)

20,419. "Control levers and handles for wireless signalling and other apparatus." A. P. Portway. August 10th, 1923. (224,586.)

20,516. "Electrical junction box." S. J. Bryce and Callender's Cable and Construction Co., Ltd. August 13th, 1923. (224,590.)

20,596. "Electric watch." M. P. Favre-Bulle. August 11th, 1922. (202,328.)

20,597. "Striking mechanism for electric clocks." M. P. Favre-Bulle. August 11th, 1922. (202,329.)

20,636. "Incandescent electric lamps." R. Caparros. August 14th, 1923. (224,597.)

20,783. "Variable electric condensers." G. W. Heath. August 15th, 1923. (224,603.)

20,844. "Electric filter circuit arrangements." H. P. T. Lefroy. August 16th, 1923. (224,606.)

21,164. "Electric couplings." H. Macfarlane. August 21st, 1923. (224,619.)

21,264. "System of wireless control." Vickers, Ltd., and C. P. Ryan. August 22nd, 1923. (224,621.)

21,569. "Telephones." Signal Ges. August 26th, 1922. (202,999.)

21,581. "Electric switches." W. Preston. August 27th, 1923. (224,630.)

21,643. "Electrically-controlled signalling apparatus." J. H. Thompson. August 27th, 1923. (224,632.)

21,836. "Construction of sound-amplifying horns or trumpets." E. A. Graham. August 29th, 1923. (224,635.)

22,135. "Composite metals and methods of manufacturing the same." British Thomson-Houston Co., Ltd. (General Electric Co.). September 3rd, 1923. (224,639.)

22,445. "Microphones and similar apparatus." Signal Ges. September 7th, 1922. (203,700.)

22,532. "Electrical heating of buildings." J. R. Quain. September 7th, 1923. (224,647.)

22,950. "Electric motors for gramophones, but applicable also for other purposes." Scottish Gramophone Manufacturing Co., Ltd., and A. B. Campbell. September 13th, 1923. (224,649.)

24,188. "Wireless apparatus." H. P. T. Lefroy. September 28th, 1923. (224,661.)

24,453. "Device for use in indicating the charged or discharged condition of a battery." Austin Motor Co., Ltd., and C. B. Walker. October 2nd, 1923. (224,667.)

24,488. "Electric traction systems." English Electric Co., Ltd., and Sir J. A. F. Aspinall. October 2nd, 1923. (224,668.)

25,066. "Attachments for telephone receivers." F. Tidy. October 9th, 1923. (224,679.)

25,669. "Electric motors for driving talking machines, dictating machines, and the like." Dr. G. Seibt (firm of) and G. Schernbeck. March 21st, 1923. (213,216.)

26,135. "Selective electric impulse-transmitting mechanism." Western Electric Co., Ltd. (G. Deakin, L. J. Joseph, and J. R. Pappi). October 19th, 1923. (224,690.)

26,208. "Automatic and semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. October 20th, 1923. (224,692.)

26,454. "High-voltage oil-immersed transformers." A. W. G. Tucker and Ferranti, Ltd. October 23rd, 1923. (224,695.)

26,788. "System of electric motor control and automatic controllers." Electric Control, Ltd., and O. Ellefsen. October 26th, 1923. (224,702.)

27,019. "Electrically-heated cushions and the like." V. G. Steer and F. M. Lennard. October 29th, 1923. (224,704.)

27,062. "Miners' and other electric safety lamps." Oldham & Son, Ltd., and G. H. Darby. October 29th, 1923. (224,705.)

28,982. "Fine-adjustment device for permanent magnets with invariable air gap used in electricity meters, measuring instruments, and the like." Landis & Gyr Akt. Ges. November 17th, 1922. (207,192.)

29,322. "Railway and tramway switch boxes or ground levers." S. S. Wrightson and C. R. Matthews. November 21st, 1923. (224,726.)

30,907. "Electric welding and like operations." Soc. Alsacienne de Constructions Mécaniques. December 8th, 1922. (208,165.)

32,300. "Electric heating apparatus." H. Goodman and Hancock & Co. (Engineers), Ltd. December 27th, 1923. (224,749.)

1924.

1,945. "Machine switching telephone systems." Western Electric Co., Ltd. (G. Deakin). January 24th, 1924. (224,767.)

2,468. "Circuit-closing devices for electric signs." E. Marre. January 30th, 1924. (224,770.)

2,669. "Systems of electrical distribution." F. W. Le Tall (Westinghouse Electric & Manufacturing Co.). February 1st, 1924. (224,772.)

3,802. "Means for heat regulation in electric domestic cooking apparatus." A. Saxegaard. February 14th, 1923. (211,490.)

7,047. "Electrical heaters for liquids." K. Illner. March 31st, 1923. (213,563.)

7,099. "Variable-resistance devices for electric circuits." H. A. Yoward. March 20th, 1924. (224,792.)

7,188. "Step-switch multiple control for the non-automatic, semi-automatic, and full-automatic operation of electric vehicles." Maschinenfabrik Oerlikon. December 14th, 1923. (224,794.)

7,312. "Method and means for obtaining synchronism between kinematographic projections and radio-telephonic emissions." C. E. E. Delacommune. March 24th, 1923. (213,282.)

8,925. "Sealing of the ends of electric cables." W. T. Henley's Telegraph Works Co., Ltd., W. R. Clements, and H. C. Hoban. April 8th, 1924. (224,800.)

9,189. "Automatic or semi-automatic telephone system." Automatic Telephone Manufacturing Co., Ltd. September 17th, 1923. (222,078.)

9,249. "Portable electric lighting apparatus." M. Bresson. April 11th, 1924. (224,805.)

9,572. "Electric bells." J. M. A. Richard and L. Gilbert. April 17th, 1923. (214,627.)

10,223. "Sparking plugs." E. A. Jackson. April 25th, 1924. (224,812.)

10,417. "Electric circuit-breaker with ultra-rapid break." Forges et Ateliers de Constructions Electriques de Jeumont. May 2nd, 1923. (215,350.)

10,898. "Systems of receiving and indirectly amplifying radio-frequency electrical oscillatory energy." W. J. Mellersh-Jackson (Westinghouse Electric and Manufacturing Co.). May 2nd, 1924. (224,817.)

13,782. "Head-lights for motor and other vehicles." Etablissements Besnard, Maris, et Antoine. June 8th, 1923. (217,229.)

14,369. "Directional reception and transmission in wireless telegraphy." M. Latour. June 13th, 1923. (Addition to 217,238.) (217,660.)

15,415. "Demagnetisation of continuously-loaded electrical conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). June 26th, 1924. (224,827.)

16,287. "Dynamo-electric generators and motors." P. Ehrmann. April 27th, 1923. (Divided application on 214,944.) (218,683.)

Electric Omnibuses in Sweden.—This question was raised by Mr. Wendt at the annual conference of the Swedish Tramway Association, which was held in Stockholm in the second week in November. The author pointed out that proposals had been brought forward on many occasions with regard to the employment of electric omnibuses equipped with secondary batteries, but they had not led—at least in Sweden—to any positive results on account of the great weight of the cells and their relatively low capacity. The question would therefore have to remain in abeyance until the problem of producing light accumulators had been solved. On the other hand, the introduction of trolley omnibuses, he said, had, or would, come. According to a graphic table presented by the author, comparing petrol or oil-driven omnibuses and electric trolley 'buses, if the price of benzine as motive fuel was taken at 20 ore per litre and that of electrical energy at 8 ore per kWh, it would be more economical to use benzine motor 'buses than electric trolley omnibuses for a 20 minutes' service. If the service were increased to one of 15 minutes, the question of economy of the two systems was doubtful, but in the case of a more frequent service of, say, five or ten minutes, the author stated that it was decidedly more advantageous to employ electric trolley 'buses, while if the price of electrical energy were lower than that stated, it was obvious that the advantages of electric 'buses were all the greater.

Large Waste-Gas Engine.—What it is claimed will be the largest gas engine in the country is in course of erection at the works of the Staveley Iron Co., Derbyshire. The engine has been made by J. Cockerill & Co., Liége, Belgium, and some idea of its general dimensions may be gauged from the fact that the crank shaft alone weighs 80 tons. The purpose of the engine is the generation of electricity by the use of waste gas from the blast furnaces.—*Evening News.*